THE
ELECTRICAL REVIEW.

VOL. LXI. NOVEMBER 1, 1907. No. 1,562.

ELECTRICAL REVIEW.

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THE SPECIFICATION INCUBUS.

SPECIALISTS in certain lines of electrical manufactures are sometimes justifiably filled with amazement at some of the requirements under which they are called upon to supply their goods. In a recent specification for conduits for electrical work, it was stipulated "That all conduits are to withstand a pressure of 250 lb. per square inch." Now it must be distinctly understood that this specification was not for a high pressure hydraulic installation; it was solely and entirely for an ordinary interior installation of tubes to carry electric wires. Moreover, the work had to be executed at competitive prices.

The genius of the person responsible for the specification did not end here; one of the other clauses was that "each casting is to withstand being dropped without a sign of fracture from a height of 9 ft. to 15 ft. at the discretion of the overseer on to an iron or steel sheet not less than 1½ in. thick." In the monthly publicity circular of a conduit firm there was drawn a picture of the overseer swarming up a ladder, throwing the castings about in an official and scientific manner, and subsequently handing the surviving articles impressively to wiremen standing about waiting for something to do. Moreover, a number of test pieces of steel of certain heights, depths, breadths, thicknesses and lengths were to be provided, and they were to have a tensile strength of 18 tons, with an elongation of 4½ per cent. in 3 in.

Finally, the manufacturer had to send with the consignment an expensive set of limit gauges in order that the customer might satisfy himself that his specification had been adhered to.

In the face of such an alarming series of conditions, the firm of conduit manufacturers referred to are surely within their rights in protesting against such fatuity. Unfortunately, however, such a specification is only a type of the hampering conditions that have been, and are being, set up in the electrical trades. We have not one word to say against the consulting engineer who is, in reality fulfilling the function of his calling. There is need for such men, provided they are specialists in the work they undertake, inasmuch as they can, by virtue of their position, obtain the most complete view of the requirements of the case under their control. There is, however, surely no need for the interference of people whose object in life appears to be the piling up of unnecessary verbiage and unnatural limitations. Manufacturers of electric light accessories are sufficiently alive to their own interests to know that in face of the keen competition at present existing, both at home and abroad, they have not a ghost of a chance of selling their goods unless they conform to the most stringent conditions required by practice, and they can be relied upon to use every endeavour to turn out a satisfactory article. The

great danger is that the forcing down of prices may lead to undue economy in material used, and to poorness of design. This can only be intensified, and not alleviated, by such specifications as the one under notice. Extreme pressure at unnecessary points produces a corresponding weakness at portions of the work overlooked in a one-sided specification. By far the safer plan, if due progress is to be made in the manufacture and supply of electrical small goods, is to leave the matter pretty much to the salutary effects of competition.

Examination or Research?

Under the above title, the *Times* of October 24th contains a somewhat entertaining letter written by Mr. F. C. S. Schiller, M.A., D.Sc., Fellow and Tutor of Corpus Christi College, Oxford, in which the writer states that he has read with passive admiration the various proposals that have been made for reforming, re-endowing and rejuvenating our older universities. He has seen many remarkable plans suggested, but in spite of the diligence with which he has perused the schemes, he finds that one of the most glaring evils of modern university life has never been mentioned. This evil is the examination system—a curse which, we were under the impression, had been held up to obloquy times without number in all the technical journals of the country, not excluding the Electrical Review. Nevertheless, as Mr. Schiller believes that he is the discoverer of the evils attendant upon the examinational system, and as he sketches the symptoms and sequelæ of the malady so well and so intimately, we may devote a few lines to his further remarks. The examination fever, we learn, is not confined to college tutors, is extremely catching, and once acquired cannot be purged from the human system. It causes the victim to seize by the scruff of the neck everyone he comes across, undergraduates and graduates, schoolboys and tender women. It renders nugatory all teaching that does not enable a student to pass an examination; it suppresses all ability and distinction that has not received the *imprimatur* of an examination; it sterilises the teachers, amongst whom research does not pay. A teacher's reputation is enhanced almost as much by the successful preparation of his own pupils as by the successful demolition of those of others. And not only so, but many of our most renowned examiners examine so continuously and conscientiously that they can hardly keep abreast of the progress made in their own subject. Mr. Schiller states that outside the university the belief in examination is even more pathetic than within. He asserts that the reason why parents and others trust so much to examinations is because they appeal to the sporting instinct and competitive cravings of a nation which takes the same interest in a "blue ribbon" scholarship as in a "blue ribbon" horse race. To some extent, no doubt, Mr. Schiller's explanation is correct, but there is another cause at least as important. The British parent has too much common sense to regard himself as an authority on education. He has been taught for generations by university professors, who, on Mr. Schiller's own showing, have an axe to grind in the matter, that the passing of a series of examinations is at once the object of education and the test of its efficiency. Indeed, "the belief in examination is the one universal creed of modern Oxford." It may well be that the worship of this idol is nearly as common in the world as it is said to be at Oxford; but, if so, the pathos of the situation is to seek in the fact that the average Englishman has been so long and so uniformly deluded on the subject of education by those authorities from whom he has a right to expect sound guidance, that he has come to subscribe to the university profession of faith in examination with all its concurrent and consecutive evils.

Electrical Engineering as a Profession in Germany.

A Berlin newspaper is publishing the results of inquiries as to professions which are full of prospects, and those which have no prospects. On the subject of electrical engineering the opinion has been obtained of Mr. Richard Werner, manager of the Siemens-Schuckert Works. This gentleman is reported to have stated that the far higher intellectual standpoint of those who finish studies at school and proceed to the university is nowhere more strikingly shown than in electrical engineering. Those persons who leave at the end of one year and then attend intermediate technical schools only, seldom do anything distinguished and scarcely ever reach well remunerated positions. They are already on hand in incredible abundance, and hundreds of competitors apply for situations of from £100 to £150 per annum. But there is a constant lack of suitable applicants for appointments worth £500 to £600. Yet electrical engineering represents a sphere full of variety and hope. What 10 or 15 years ago was one trade has now been divided into twenty. Among these, Mr. Werner mentions apparatus for high and low pressure, cable manufacture, the construction of direct and alternating-current machines, tramway and railway work, electro-chemistry, signalling, telegraphy and telephony, the transmission of power, &c. It is probable that the period of high prosperity has now been passed, but the large companies are still unable to promise speedy delivery. The slackening in the prosperity is taking place in a healthy manner; it indicates a period for rest for the technician and is of advantage to the precision of apparatus. The manager of the Siemens-Schuckert works proceeds to state that those who have passed their school and high-school examinations according to proper order have the prospect of being successful. They need not perhaps be talented constructors (engineers); but they must know how to unite with fundamental technical knowledge and with the practical look of the technical man, commercial ability and a representative appearance, whilst a mastery of French, English, or Italian, is of admirable assistance. It is often necessary for the propagation of the single idea of a single talented constructor to employ 300 commercial engineers who all receive high salaries, but such persons are lacking in the electrical engineering industry. In conclusion, Mr. Werner advises those persons to become electrical engineers who are willing to proceed fundamentally with their studies, and who have reason for the assumption that they will also become capable commercial engineers.

The West Hampstead Collision.

It is a matter for sincere regret that last Saturday morning's accident at West Hampstead station should have resulted in a number of fatalities, thus spoiling the otherwise unbroken record of the Metropolitan Railway for freedom from fatal collisions. That the record should have been maintained so long is, under the circumstances, really marvellous. The accident occurred in a thick fog, and was caused by a down express train overtaking a down stopping train, standing at the platform; the collision resulted in the telescoping of the last carriage of the stopping train, three persons being crushed to death and several injured.

Major Pringle, R.E., visited the scene of the accident shortly after the collision, and in the beginning of the week conducted an inquiry into the matter on behalf of the Board of Trade.

With his finding we are, however, not at present concerned. To us an instructive comparison exists between the Metropolitan and Metropolitan District Railways; both operate electrically and under very similar conditions, but the former utilises the old lock and block system of signalling, in which, of course, an indiscretion on the part of the signalman may, and frequently does, result in disaster, while the latter is equipped

throughout with the Westinghouse electro-pneumatic system* which, owing to its automatic operation and to its signal operators (where employed) having an exact replica of the track and moving trains always before them, obviously has many points in its favour. Had, for instance, the above system been working at West Hampstead, the control of the signal safeguarding the section containing the standing train would, in any case, have been automatically secured, and had the motorman in charge of the on-coming train failed to see a danger signal, the presence of the automatic stop connected with the signal would have ensured the application of the brakes.

It must be admitted that manually-controlled signalling plays an all-important part in the railway working of this country, but where an average of 36 trains an hour for eight hours on end has to be dealt with, as in this instance, the presence of the personal equation in the signalling operations cannot possibly be regarded with equanimity.

The Halifax Tramway Accident.

The inquest on the unfortunate men who met their fate in this accident, has resulted in a verdict of "Accidental death" being returned by the jury. No other verdict could very well have been given in view of the facts elicited by the Coroner's inquiry, from which it appears that a defective controller was at the root of the matter. A short abstract of the evidence on the main points is given elsewhere, and it is at least satisfactory to note that the driver did his best under the very trying circumstances which existed at the time.

Even allowing for the somewhat abnormal activity of the circuit-breakers controlling the supply to this particular route, which would add complication to the already complicated brake operations of the motorman, the whole matter seems, as we hinted last week, to turn on the brakes. Three brakes, wheel, slipper and electric, were fitted on the car, and the evidence seems to hint at even a fourth, viz., a run-back brake; the driver testifies to having applied the electric and slipper brakes shortly after the car commenced its disastrous backward journey, but clearly they were ineffective in the emergency conditions existing. The former was, we know, practically useless, owing to a loose connection in the controller. But what about the latter?

Glancing back at the long list of runaway accidents on electric tramways in recent times, one realises more than ever the urgency of a solution of the brake question, interlinked as it is with the every-day running of thousands of cars with their human freights.

The Motor-'bus.

The motor-'bus is taking a back seat. Lord Montagu of Beaulieu, in an address to the Society of Road Traction Engineers on October 21st, said that there might be some difficulty in producing the omnibus that the police and public required, but in 5 or 10 years' time it would be equal, if not superior, to any of its rivals.

Questions occur to us. Do the rivals include electric tramcars, underground railways, the elephant at the Zoo, and Mr. Edison's very latest five-million-mile motor-car?

Will the motor-'bus be superior in 5 or 10, or any conveniently slipshod multiple of 5 years, to its rivals as they stand now, or does Lord Montagu of Beaulieu see clearly not only the far future of the motor-'bus, but that of its rivals also?

Will Lord Montagu pledge himself that within the next 5 or 10 years something far in advance of motor-cars and tramcars will not have been developed?

* See Electrical Review, March 15th and 22nd, 1907.

WINDMILL ELECTRICITY WORKS IN DENMARK.

The two greatest drawbacks in utilising the wind for power purposes are irregular velocity of the wind and unreliability. These drawbacks have, however, been partially overcome after long experimenting, and there are now in Denmark between 30 and 40 windmills driving electric generators.

The Danish Government supported the attempts to work out the utilisation of the wind for generating purposes, and an experimental station was erected at Askov some time ago by the Government.

The man who chiefly interested himself in these experiments was Paul La Cour, who rendered multiplex telegraphy possible, and is also an inventor in other fields.

The old mill at Askov, which had four arms, about 2 metres wide and 6 metres long, was used to electrolyse water into hydrogen and oxygen. The old mill has, however, been replaced by a new one, whose arms are 7·4 metres long and 2·5 metres broad, the height of its axis from the ground being 13 metres.

This mill drives two dynamos, of 12 H.P. each, part of the current generated being used for electrolytic purposes; the

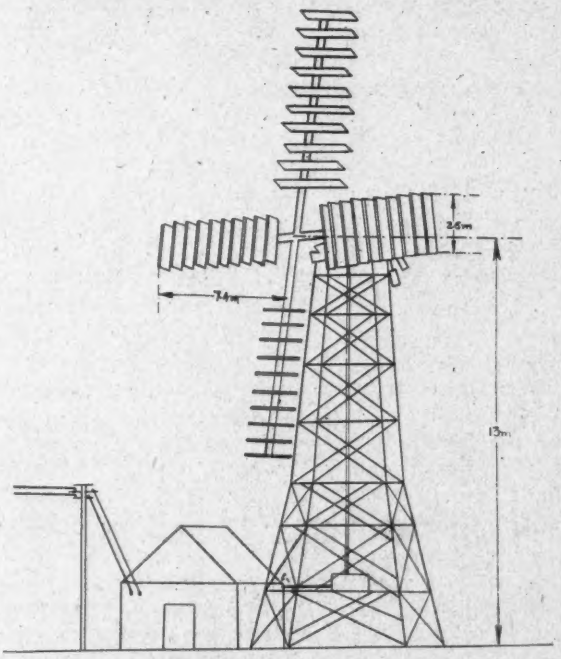


Fig. 1.—Windmill at Askov.

rest goes to charge the accumulators, which supply the current necessary to light 700 glow lamps, five Nernst lamps, four arc lamps, and eight motors, the total being about 21 H.P.

According to La Cour, the following points are of most importance:—

1. The axis of the mill should be at a high level from the ground, the higher the better.

2. The windmill should not be of the old type, or the modern disk type. Four arms are most effective, as a smaller number would not use the wind to its full extent, and a larger number causes wind currents between the disks, thus minimising the impinging force on the vanes.

3. The tips of the wheel arms should revolve at about 2·5 times the wind velocity.

The diameters of the arms at right angles to one another should be set with adjustable blades, inclined to the direction of motion by angles ranging from 10°-25°.

4. When the wind strikes the blades it should not do so with a shock and thus cause eddying.

5. The formula obtained with this mill was:—

$$H = \frac{A\,v^3}{1{,}250},$$

where H = horse-power, A = wheel area in square metres, and v = wind velocity in metres per second.

D

Thus, a medium-sized mill, with an exposed blade area of 48 sq. metres, will yield 8 H.P. at a wind velocity of 6 metres per second, while at 8 metres per second, about 16 H.P. would be produced, and this latter velocity is not rare in Denmark.

These successful experiments led to the formation in 1903 of the Danish Wind Electricity Co., its installations in Denmark now numbering between 30 and 40.

These installations have been described by Paul La Cour, to whom some important devices used in them are due. As a typical example of these mills, we may describe the one

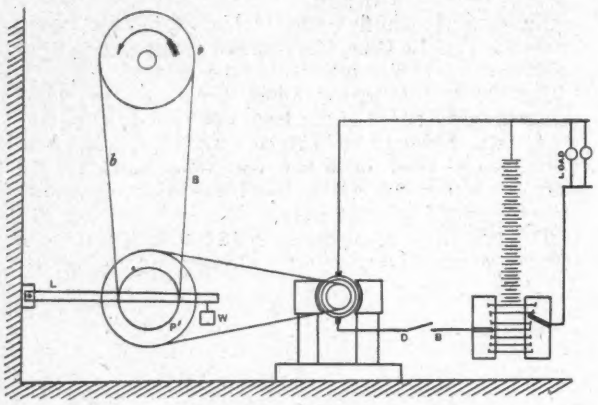


FIG. 2.—ARRANGEMENT OF GENERATING PLANT.

at Valle Kilde, in the north of the largest Danish island of Seeland (Sjülland). The mill in fig. 1 is situated on a hill, the dynamo room being at the base of the tower.

The axis is 43 ft. from the ground; each of the arms has 10 transverse blades, 2·5 metres in length, whose inclination can be altered by means of iron rods in tension.

At right angles to the axis are two little disk wheels. When the wind blows obliquely to the axis, these disk wheels turn the axis of the mill parallel to the wind, by means of toothed gearing.

The effective area of the blades is 31·5 sq. metres (240 sq. ft.), and at a wind velocity of 7 metres per second, will yield 8·6 H.P. at 24 R.P.M.

As will be seen in fig. 1, the shaft enters the dynamo room at A, where a main pulley P (fig. 2), drives another pulley P_1, whose shaft runs on a weighted lever L; a pulley of larger diameter on the same shaft runs the dynamo.

When the difference between the pulls in the driving and driven sides of the belt, B b, is beyond a certain value (this can be altered by adjusting the load on the lever) the belt starts slipping, and the arrangement will adjust itself.

As the speed increases, the slipping increases, the turning moment remaining the same, and the speed of the dynamo alters so that the current and pressure on one side, and the moment and speed of dynamo on the other side, balance each other.

The speed of the dynamo adjusts itself to the charge left in the battery, and the current to the load on the weighted lever, hence the entire system is balanced.

If the pressure of the battery be suddenly altered, the speed of the dynamo at once varies, as indicated by the humming noise produced by the machine.

If the dynamo voltage were less than the battery voltage, on account of the speed, the cells would discharge through the dynamo, and run it as a motor; to prevent this happening, a device known as the "Key of La Cour," has been inserted in circuit, diagrammatically shown in fig. 3.

S is a steel permanent magnet, to which is connected by means of a pivot at O a copper rod, which may dip in either or both of the mercury cups C_1 and C_2.

D is the dynamo terminal, B the battery terminal, S a high resistance winding, S_1 a few turns of stout copper wire.

When the wind drops, a very weak current flows from B to D through the high resistance winding to the dynamo terminal, attracting the magnet pole to the right, the copper rod dipping in C_1, while the remaining cup circuit is broken. When the wind increases, the current changes its direction in the high resistance winding, the magnet pole is attracted to the left, and the copper rod is immersed in C_2, thus closing the main circuit through the low resistance winding.

The dynamo in Valle Kilde yields 50 amperes at 110 to 160 volts, or 5½—8 KW.

A petrol motor has been installed as an auxiliary source of power, should the wind fail for some time, but in seven months' working it has only been used for 70 hours.

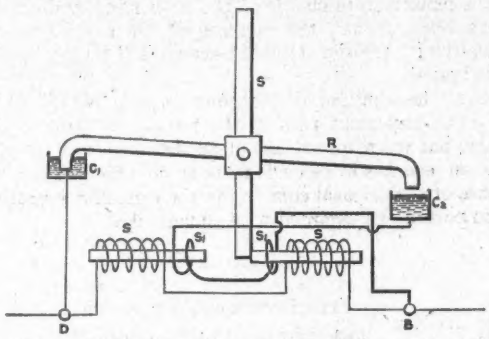


FIG. 3.—LA COUR RELAY FOR PROTECTING DYNAMO.

The battery consists of 60 cells of 600 ampere-hours' capacity. A grinding mill, a circular saw (4·5 H.P.), and other small machines, are connected to the mains.

In the winter the maximum output per day was 270 ampere-hours. The cost of the mill was as follows:—

1. Windmill, pulleys and belts...	£138	10	0
2. Dynamo and accessories	50	0	0
3. Petrol motor and accessories	120	10	0
4. Accumulators	218	0	0
5. Cables, lighting material, &c.	37	10	0
6. La Cour key, lightning arrester, &c.	24	0	0
7. Building (dynamo room), tanks for petrol ...	70	3	0
8. Wages and goods carriage	80	5	0
Total	£739	0	0

From the above total figure we can see that the prime cost is really the only important outlay, as the cost of upkeep is extremely low—the fuel, of course, being free.

That the mills pay well may be seen from the number of such installations in use in Denmark.

ET CETERA.

[COMMUNICATED.]

IN these days of strenuous load-hunting, it is well, every now and again, to pause and examine our methods with some care, and to consider whether all our efforts to secure new business are entirely well directed or otherwise.

So many "systems" and "schemes" have been offered us of late, and such a wealth, or rather, quantity, of matter relating to "publicity methods" has recently been written, that the very word "publicity," in a great many instances, stinks in our nostrils; and yet, well directed effort in canvassing, as we used to call it, has an enormous effect on the monthly additions to circuits, and it is here proposed to indicate a few of the kinds of load that are waiting to be picked up, and to show how this may be done without upheaval of organisation or drastic change of method, either of which are usually bad for any concern.

It should be obvious that it is absurd for any one person to attempt to set forth a method of canvassing or advertisement that shall be universally applicable, if for no other reason than that no two areas of supply are exactly similar, and the writer does not propose to attempt this absurdity, which is somewhat fashionable nowadays, but will merely indicate a method which can easily be adopted by the average station, without, at first, any additions to staff or expense, save that of printing.

A cursory glance through the "monthly additions to circuits" of an average station, shows a varying proportion

of "lights," "motors," and "et cetera," so divided because of the historical order of their acquisition, and usually valued much in the same order, lighting first, then motors "to level up the curve," and finally "et cetera," a sort of rubbish heap for every thing which will not fall into the other two main classes.

Now, it is this group "et cetera," which is actually, or is going to be, of the very greatest importance to the station; as in comparatively few cases out of the 400 odd stations in the kingdom, is the district such a one as will yield a good day motor load of reasonable size, and frequently the expense and trouble of hunting and connecting up an individual motor is out of all proportion to its value to the station from a load-factor point of view.

On the other hand, *every* consumer of light is a potential power consumer for heating and cooking at least, if not for one or other of the numerous uses mentioned below, and it will be found that the heating and cooking load alone will, in time, be the most important to the station both from a "units sold" and load-factor point of view.

It may not be out of place here to tabulate a few of the numerous power uses of electricity (exclusive of "factory driving") which fall together into the "Et Cetera" group, as it is very often only ignorance of what can be done electrically that keeps the potential power consumer off the mains.

A list of trades is given together with appliances which may well be electrically operated in each, omitting, as mentioned above, genuine factory users.

Trade.	*Appliances.*
Aerated water manufacturers.	Bottling machines and washers.
Analysts.	Furnaces and laboratory outfits.
Assayers.	" " "
Bakers.	Mixing and whisking machines, ovens.
Bars.	Water-heaters, &c.
Barbers.	Brushes, water-heaters, curling iron ditto.
Blacksmiths.	Blowers, drills.
Bootmakers.	Stitching machines.
Bottlers.	Washing machines, corking ditto.
Builders.	Hoists, mortar machines.
Butchers.	Refrigerators, sausage and chopping machinery.
Carpenters.	Glue pots, circular saws.
Chemists.	Sealing-wax heaters, pill machines, siphon fillers.
Coffee-rooms.	Hot plates, urns and cooking in general.
Confectioners.	Mixing and whisking machinery, sweet-making ditto.
Corn chandlers.	Chaff-cutters.
Cutlers.	Grinding and polishing machinery.
Dairies.	Refrigerating, Pasteurising, churns, separators.
Dentists.	Furnaces, drills.
Dining rooms.	Cooking apparatus, service lifts, &c.
Dressmakers.	Sewing machines.
Fishmongers.	Refrigerating machines.
Furriers.	" "
Garages.	Charging circuits.
Gasfitters.	Soldering irons.
Grocers.	Coffee roasters, grinders, blending, and sifting machines.
Hairdressers.	Brushes, hairdryers (ladies) see Barbers.
Harness makers.	Stitching machines, brands, leather irons.
Hatters.	Blocking machines and irons.
Hotels.	Service lifts, knife and boot cleaners, billiard table irons, cooking apparatus.
Jewellers.	Polishing and buffing machines, lapidary wheels.
Joiners.	Glue pots, circular and band saws, morticing machines.
Laundries.	All machinery, irons.
Leatherworkers.	Irons.
Mathematical instrument makers.	Lathes, polishing tools, &c.
Metallurgists.	Furnaces.
Mineral water manufacturers.	See Aerated water ditto.
Optical instrument makers.	Lathes, polishing and grinding machinery.
Plumbers.	Soldering irons, metal pots.
Photographers.	Printing and studio arcs.
Print makers.	" " "
Public houses.	Hot-water heaters, cigar lighters.
Tailors.	Sewing machines, gooses.
Tobacconists.	Cigarette making machines.
Umbrella makers.	Lathes and stitching machinery.

The above list does not profess to be anything like complete, but may serve as a skeleton for further additions, and to show the large field awaiting development; but even large though it be, it ought to be entirely eclipsed by the load obtainable from the residential portion of the district.

It is in the ordinary private houses that there is an enormous aggregate load to be picked up, and now that most stations offer electricity for all other purposes than lighting at a very low rate, there should be little difficulty in stimulating a large demand from this source. It is usually only ignorance of the possibilities, as mentioned above, that is the chief cause of the absence of this demand, and the station must do the educating.

Before considering how this is to be done without great changes in staff and method, a few of these household uses may be tabulated:—Radiators and convectors; cooking apparatus of all kinds; flat-irons, fans, sewing machine motors, knife and boot cleaners, heat and electric baths, bed-warmers, foot-warmers, &c.; and, for doctors and dentists, medical apparatus, drills, furnaces, cautery wires, &c.

It is, of course, from heating and cooking that the largest load is to be looked for, and this should be the first to be hunted, though the others are by no means to be despised, as they total up to a very large extent (in one small American town the irons alone produced a new Tuesday morning peak!), and they possess a supreme advantage in not requiring a separate circuit, as the lighting wires will usually carry them, and consequently they are usually used at the lighting rate.

[In passing, it may be said here that the sub-meter question presents no difficulty at all; it is usually the circuit wires that are the trouble, being seldom, if ever, bigger than is absolutely necessary for their primary lighting work.]

As an instance of what may be expected in the way of load, experience shows that a house wired for, say, 50 lights will use on an average (in London) about 850 units per annum, which are, of course, all peak load; and the same house not very well equipped with heaters, &c., will easily take another 1,500 units on the cheap rate, with a vast improvement in load factor.

Now, as to the obtaining of this load by means of the ordinary staff and methods of the undertaking, the most useful means of conveying information to the consumer is the quarterly account and receipt post.

Too often the correspondence between station and consumer is, from the consumer's point of view, extremely uninteresting and disagreeable, consisting entirely of demands for money or arguments concerning correct meter readings, until the consumer grows to consider the station as a sort of "It's-your-money-we-want" monster, which is, of course, quite wrong, even though it be a "progressive" station.

There *must* be a quarterly post, so let it be used as a means of advertisement by means of "enclosure slips," and also let the obnoxious account and only less objectionable receipt bear their part with reasonably designed or worded advertisement on the back.

"Reasonably" is said advisedly, as such statements as those circulated on the accounts of some gas companies are so extravagant as to carry their own refutation with them.

Then, again, with the "enclosure slip," examples of which are given later, a reply card should go asking for a representative to call. At first the result of these slips will be small, perhaps very small, but it will grow, and very soon the requests for representatives' calls will be more than the ordinary canvassing staff can cope with, *then* get more canvassers, but don't make the mistake of trying to stir up business by canvassers' calls from house to house.

More often than not these are resented, the caller getting no further than the front door, and, indeed, being often asked to go to the side door, which all tends to the disrepute of the undertaking, whose representative ought to be distinctly more than a mere "man from the electric company," or bagman.

The representative must, above all, be a "gentleman," a man who can meet anyone on equal terms, and, in short, a man whom consumers will want to see, not one they will wish to avoid because of his insistence.

The desire must be created first (this refers to additional new business), and, as a general rule, much more attention is paid to a canvasser who only calls after an appointment by letter, than to a doorstep haunter.

A very useful form of advertisement is a short chatty

pamphlet setting forth the advantages of electricity for one particular purpose; a great mistake is made in bombarding a man with a heterogeneous assortment of odd advertisements; stick to one subject at a time. Let the "slip" and pamphlet, if sent together, both treat of the same subject, and let the slip be, as it were, the "text" for the pamphlet.

Above all, let the literature be well got up, cheap printing never pays, as it usually goes straight into the waste paper basket; on the other hand, over elaboration is wearying, so let there be a happy medium, and always send an appointment card with each pamphlet.

Such is a very brief outline of a method of "Publicity," which can be grafted, and usually successfully grafted, with very little extra expense on to the ordinary routine work of any supply company, and whose results very quickly justify the extra expense of the printing, &c., involved.

The following are suggestions for "Enclosure Slips," most of which have been used with good results, and a few advertisements for the back of the account and receipt. These with a few short pamphlets on, say, "Electric Heating," "Electric Cooking," and "Small Power Users of Electricity," will be found to be quite sufficient to stir up such a volume of business as will probably necessitate very shortly an additional canvasser or two on the staff. Examples of "Enclosure Slips":—

The Coming Winter.

Electric stoves are ideal for obtaining heat instantly. They are clean, healthy and require no attention. Try one in your bedroom.

The Servant Question.

The adoption of electric heating and cooking will, to a large extent, solve the servant difficulty for you.

Appointment Card (addressed to station).

Please let your representative call on

Name ....

Address .....

with reference to electric { Lighting, heating or cooking power,

on ——day, at —— o'clock.

The Coming Winter.

Coal prices are steadily rising, and fires are always a nuisance. Why not try radiators? They are clean, cheap, and effective.

The Servant Question.

Electricity already lights your house, rings your bells and puts you in touch with all your friends; why not let it clean it, your boots, knives, and do your cooking and heating?

Advertisement for Account.

If electricity is really from two to ten times as dear as gas, why do —— thousand people in your neighbourhood use it exclusively?

A few examples only are given, as the wording of such advertisement is just one of the points where local knowledge is essential.

The gist of the whole method lies in utilising a necessary feature in the every-day routine of every station—viz., the post—as a strong educational advertisement medium, and using the canvassing staff chiefly after making appointments.

ELECTRIC TRAMWAY ACCOUNTING AND FINANCE.

By ELECTRIC.

The book-keeping and accounts of Electric Tramway Companies may be somewhat dry and monotonous; but like those of other special industries, they possess more or less inherent and interesting characteristics, which it is proposed to indicate and consider in the course of a series of articles under this title. The accounting of such companies in the ordinary course is comparatively simple; but, *inter alia*, lack of capital — working and/or otherwise — which may be the *raison d'être* of adverse and burdensome financial and other agreements, which, if badly drawn, as they often are, may give rise to diversity of opinion in interpretation, and probable litigation, may be responsible for a possible degree of intricacy. True it is that arrival at a proper solution, when these broadly indicated incidents do occur, is frequently hampered or even eventually frustrated by the introduction of the fads and barren opinions of some self-important facetious theorists, who are in some cases occupying posts in the electrical world to-day principally by virtue of the sustenance which they derive from the brains of the less favoured. Some of these individuals would be at once expert electrical financiers, managers, accountants, and goodness only knows what, to the constant irritation and disgust of able members of boards who are free from scheming vices; but electric tramway boards were ever thus taxed with one or two examples breathing such impossible aspirations. We have seen some who could but ill effect the reckoning of the cost of any item per car-mile to two decimal places. Exceptional, no doubt, but they succeed; and outwardly charming, of course, to the last degree. Could some of our electric tramway board rooms speak, what tales they could tell, and how interesting they would be; but unfortunately minute books only record proceedings in dull uninteresting stereotyped terms.

But let us proceed. The designs of the books in use are more or less general, varying only here and there in minor details according to the requirements or necessities of special circumstances, and as the subject of electric lighting accounts is preferably treated in separate articles, we shall confine our attention, in the first instance, so far as the consideration of the books is concerned, to a tramway company purchasing its energy from a local authority or a company. The precise organisation naturally also varies according to particular circumstances; but it may be represented by—(A) Directors, secretary, accountant and staff; (B) Manager and engineer and staff.

The office of manager may be separate from that of the engineer, or it may be combined, according to the magnitude of the undertaking and the qualifications of the person appointed.

The principal books commonly in use, in addition to the usual stock and share records, are purchase journal or purchase book, cash books, journal, and personal and impersonal ledgers. The existence of bills payable from time to time, whilst justifying the use of a Bills Payable Book, invariably indicates a paucity of capital or that the current finances are not quite "cash." They also invariably mean either increased price or the equivalent in interest, and though their use may be too easily vindicated, they should be somewhat foreign to an electric tramway company, except perhaps in the construction stage, and then only to a moderate extent. The writer has in mind one or two electric tramway companies in particular, which at one time were "too respectable, you know," to accept such useful instruments of credit, though they were not slow to take attenuated credit, and then, curiously enough, graciously discharge their indebtedness by a reduced amount as for cash, which, of course, is equivalent to taking inordinate credit and paying oneself for taking it. "Sharp practice you call it, eh?" Commercial impertinence probably would be the more apt expression. But in some cases it is impertinence which commands, but never deserves admiration and success—whether it be of the suave or audacious description matters not—in fact, it is frequently one of the chief processes by which some have climbed the promotion ladder.

The Purchase, or Invoice Book, may be framed on the columnar system, somewhat as follows:—

Date.	Name.	Particulars.	Ledger folio.	Details.	Total.	Analysis of accounts.					

In this book are recorded all accounts after payment, which it is a usual practice to post therefrom to the credit of the personal accounts in the personal ledger, and the analytical totals to the debit of the impersonal accounts concerned in the impersonal ledger. Incidentally, personal ledger accounts are by no means necessary, and if a systematic procedure of payment be in vogue, it is in many cases for all

practical accounting purposes advantageous to dispense with them. As a matter of fact, the book itself may be disregarded without fear of confusion, and with probably a reduction of clerical labour—a matter to which we shall refer again at a later stage. The titles assigned to the vertical columns for the allocation of the individual invoices depend upon the nature and accounting destination or allocation of the trade purchases invoiced, and of the miscellaneous charges for which accounts have been rendered and paid. As far as possible, however, the titles should be arranged to correspond with the more or less fixed titles in the impersonal ledger, with, of course, due regard to the relevancy of the nature of the accounts allocated. In a well-arranged concern, the usual titles will be as follows :—

Stock (Materials and Stores).
„ (Loose and Fixed Tools).
„ (Stationery).
„ (Tickets).
„ (Clothing).
Water.
Gas and/or Electric Light.
Rates and Taxes.
Licences.
Punch Hire.
Law Charges (Revenue).

In the construction stage the allocations will consist, of course, of capital expenditure, *e.g.*, payments on certificates to contractors on account of permanent way construction. Similarly in regard to electrical equipment, and so on. Where the work is being done by administration, the expenditure will appear through properly allocated wages, salaries, expenses and material accounts. The Cash Book may be modelled with advantage as follows :—

Date.	Ledger folio.	Particulars.	Details.	Traffic receipts.	Sundries.	Bank.	Date.	Ledger folio.	Particulars.	No. of voucher.	Discount.	Details.	Bank.	Analysis.		
			£	£	£	£					£	£	£			

As will be seen, the form renders the use of a Purchase Book unnecessary, and where, as already mentioned, invoices and accounts are regularly paid, its adoption may be recommended. The analysis columns may also be dispensed with by the use amongst other methods of Guard Books in which the invoices and accounts are neatly pasted, endorsed, numbered and indexed, a summary of each page being posted to the nominal or impersonal accounts concerned. For example :—

20 (Number of page).

John Jones & Co.			36.	
April account	...	£1,426	0	0
Allocation.				
P. way (cap.)	...	£1,400	0	0
Stock (stores)	...	26	0	0

It will be noticed that provision is made for the daily traffic receipts paid into the bank, which are advised to the head office on a proper form ; a special column being provided also for receipts from sundry sources, *e.g.*, Advertising, Transfer Fees, &c. The Traffic Receipts column is posted in periodical totals to the Traffic Receipts Account in the Nominal Ledger, and the sundry items to the accounts to which they relate. On the credit side there is a special column for cash discounts, which are transferred periodically in total to the debit side of the Cash Book, and posted thence to the credit of Discount Account in the Nominal Ledger, each payment being appropriated in the analysis columns to its proper title. The totals of the analytical columns for the year or less period are posted to the debit of the corresponding titles in the Nominal Ledger. We shall return, however, to this analysis in connection with returns from the Manager and Engineer's office. All payments recorded in this book are, of course, made by cheque or other instrument of withdrawal from the bank. For the record of petty payments, *i.e.*, payments other than by cheque, a Petty Cash Book is used, which is periodically analysed, the total summary being invariably chargeable to the General Expenses Account.

The form of the book is as below :—

Date.	Cash Book Folio.	Particulars of receipts.	Details.	Total.	Date.	Payments.	Details.	Total.	Analysis.		

The Journal, of which there are several forms in use, which we need not reproduce here, is used as a medium for the record of certain opening and closing entries, correction of errors, transfers, and for the record of transactions for which the other books of account are unsuitable.

The form of the Bills Payable Book, to which we have referred, is as follows :—

No.	Ledger folio.	By whom drawn.	On whom drawn.	Date accepted.	Where payable.	Date of bill.	Currency.	Amount.	Due date.												Remarks.
									Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.	

When the bills are accepted, particulars of them are entered in the Bills Payable Book and the individual items posted to the debit of the personal accounts concerned, the totals being posted to the credit of Bills Payable Account in the Nominal Ledger. When paid, cash, of course, is credited and Bills Payable debited.

Nominal or Impersonal Ledgers.—In a fairly large undertaking it may be advisable to employ two ledgers for the record of the impersonal accounts, viz., Revenue and Capital, the former containing all items for incorporation in the revenue account of the company for each financial year, and the latter all capital and capitalised expenditure for inclusion in the Capital Account or Accounts. The titles of the principal accounts opened in each ledger may embrace most of those included in the following summary :—

Capital Ledger.—Share capital ; debenture capital ; preliminary expenses ; legal and parliamentary expenses (*i.e.*, acquisition of order) ; land ; permanent way ; buildings (depôts, sheds and offices) ; electrical equipment ; cars (complete) ; office furniture ; purchase of undertaking.

Then follow the floating capital accounts, such as the various descriptions of stores, deposits, and so on.

Revenue Ledger.

(A) *Operating Expenses*, including wages of motormen and conductors, inspection and clerical wages, superintendence, clothing, tickets, punch hire, fuel, light and water, rents of offices or depôts, rates thereon, licences, purchase of energy, office cleaning, &c.

(B) *Repairs and Maintenance*, which will embrace buildings ; cars and other rolling stock ; permanent way ; electrical equipment ; tools and plant ; cleaning and sanding of track, and cleaning and oiling of cars may be included in either (A) or (B).

(C) *General Expenses*, which include salaries (secretary, accountant and office staff) ; directors' remuneration ; rents, rates and taxes (other than those included in "Operating Expenses") ; law charges ; printing and stationery ; insurances ; compensations, &c. ; then we may have debenture interest, interest on loans, dividend account or accounts, renewal appropriations, and so on.

This is but a cursory view of the principal functions of the chief books in use in the head office, which may be amplified in the following observations upon inter-departmental arrangements.

Traffic Receipts.—The traffic office advises the head office daily of the value of tickets issued and sums banked in the following terms :—

Route.	No. of cars.	Car-miles run.	Average fare per passenger.	Receipts per car-mile.	Amount.	Tickets. 1	2	3	4	Total.	Remarks.

Amount Banked.

Weather.

Remarks.

———, *Manager.*

These advices are entered on the debit side of the Cash Book in the Traffic Receipts column, and the entries checked from time to time with the Pass Book. They are prepared from the Traffic Book kept at the local office, which may be in the following form :—

Date.	No. of car.	Route. Journeys.	Car-miles.	1d.	2d.	3d.	4d.	Total.	Receipts.	Mileage. Per car-mile.	Remarks.
1											
2											
3											
4											
5											
6											
7											
Total for week in red ink.											
8											
9											
10											
11											
12											
13											
14											
Total for week in red ink.											
Aggregate...											
15											
16											

The book is written up from the Way Bills, which are checked daily with the cash received, tickets issued and returned before entry.

With regard to "shorts," each manager has his own particular way of dealing with this item, the "shorts" representing a deficiency of cash compared with the value of the tickets issued and returned. Any overs are usually allowed to the conductors. In any case deficiencies must be made good, the Manager very often arranging for the deduction of the amount from the conductors' wages.

Weekly Traffic Wages.—The compilation of the weekly traffic wages is recorded in the Wages Book, which may be in the subjoined form :—

Name.	Description.	Time.							Total.	Rate.	Amount.	Deductions.	Amount payable.	Allocation. Motormen.	Conductors.	Inspectors.	Clerical.	Cleaning and sanding permanent way.*	Cleaning and oiling cars.*	Sundries.

* Where the men are included in the Traffic Department.

The cheque for the weekly traffic wages is usually drawn by the Head Office, and debited directly to Operating or Traffic Wages. So far as the accounts in the Nominal Ledger are concerned, there is no necessity rigidly to observe the classification given in the form. Any information required relative to certain descriptions of Expenditure can be abstracted readily from the Wages Books or Wages Sheets.

The monthly remuneration of employés designated under the more euphonious title of salaries, it is the usual practice to pay by cheque from the Head Office, the amounts invariably being entirely chargeable to Traffic. The sums so paid are, however, allocated on the same lines as those appearing in the Weekly Traffic Wages.

(*To be continued.*)

CORRESPONDENCE.

Letters received by us after* 5 p.m. on Tuesday *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Corrugation of Rails.

I think it is about time that the correspondence upon this important matter was revived, and with a view to stimulating a discussion, I beg to submit for comparison a few of my own observations made at various times and places.

1. Although it is possible that corrugation may be proceeding in all states of the weather, its effects are more noticeable when the track is in a wet condition and covered with a fine greasy mud.

This suggests that corrugation is probably promoted by a slight greasiness of the rails, and is therefore connected in some way with a slipping action of the car wheels.

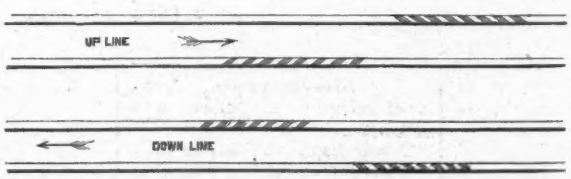
2. When the conditions set out in paragraph 1 exist, it will be found that after the passing of *certain* cars, a succession of bright thick smudgy lines appear on the rails, about 2½ in. apart. These bright lines exhibit peculiar and highly significant features, the study of which appears to me to offer the surest method of fixing the real cause of the trouble.

The fact of the marks being so bright suggests that the rail has been recently subjected to some considerable friction, and that it is as a result of such friction that the phenomenon of corrugation takes place.

3. Upon a level road, and where two sets of rails are employed—*i.e.*, an up and down line—it will be found that the bright marks are not formed at right angles to the length of the rails, but have a distinct rake.

This circumstance tends to disprove the theory that the trouble is due to irregularities produced upon the surface of the rails during the process of manufacture, because it would only be reasonable to expect that such irregularities as those would show themselves at right angles to the length of the rails, and not obliquely.

4. The bright lines are found almost invariably to slant inwards, in the direction in which the cars travel, thus :—



This confirms the argument set out in the preceding paragraph, because even supposing that it could be shown that the rolling mill did produce oblique corrugations, how is it to be explained that the angle of the corrugations is always connected with the direction of the traffic, as shown in the above diagram ?

5. Some cars produce brighter and more pronounced marks than others, indeed, many cars leave practically no marks at all.

This clearly shows that the trouble is largely, if not entirely, due to some peculiarity in the condition or construction of certain individual cars.

6. Although both rails may be permanently corrugated to the same extent, it will be found that no individual car will leave bright marks on both rails at the same spot. The marks appear in periods, ranging from 1 ft. to several yard in length, and usually pass from one side of the track to th other. This appears to show that the bright marks a formed when the wheels on one side of the car are pressi

closer against their respective rail than the wheels on the other side.

7. It will generally be found that the marks are not equally distinct throughout a period—they commence faintly, reach a maximum, and then slowly fade away again.

This fact, in conjunction with that set out in the preceding paragraph, tends to show that the marks correspond with the swaying motion of the cars from side to side.

8. Corrugation does not appear to be general throughout any town or even district. It varies considerably in degree at different points, even where the density of the traffic, the form of the road and the condition of the track appear to be otherwise very similar.

This shows that the cars are not wholly responsible for the trouble. Amongst other factors that may deserve consideration being (1) a want of truth in the gauge of the track; (2) the nature of the subsoil and road material; (3) the width of the street; (4) the height of the houses and the material used in their construction; (5) the steepness of the hills and the use of slipper brakes. The nature of the material used in making the roads is an important factor, because it has been found on the Indian State Railways that when "brick earth" is used for ballasting the permanent way corrugation almost invariably occurs. With regard to the width of the streets, &c., everyone will be familiar with the "roaring" sound produced when a train rushes along a deep, narrow cutting formed in very hard rock.

It is also possible that the practice of using the same cars on the same route for a long period may cause the wheels to wear unevenly, more especially when there are more curves to one side of the track than the other.

However, the circumstance mentioned in paragraph 5 would appear to show that the cars have something to do with the trouble; and the first thing is to spot the offenders and have them carefully examined, with a view to seeing whether they exhibit any marked peculiarities. Especial attention should be given to the diameter of the wheels and the shape of the tread of the tires.

A few men should be stationed at suitable points with instructions to examine the rails after the passing of each car. If the characteristic bright lines appear, the number of the car should be taken, and special notice taken of it on subsequent journeys. If a car is found to leave marks on each journey throughout the day, it should be marked down for examination.

The rails at the points of observation should be kept damp with a thick mixture of fine mud and water.

The subject demands a more systematic investigation than has hitherto been given it, and I would suggest that you invite all tramway engineers throughout the country to join in some concerted method of inquiry during the coming winter.

The matter is of greater importance to municipal bodies than is generally recognised. The nerve-racking uproar created by the cars when passing over corrugated track is seriously depreciating residential property and reducing its rateable value.

D. Evans.

Tramcar Brakes.

We have always followed the articles which appear in your paper from time to time on the subject of tramcar brakes with great interest, and with much of what we read we are in complete accord. We view your editorial attempts, however, to bring about the abolition of hand-operated wheel brakes as doomed to failure—at least, until an absolutely reliable substitute for the various other forms of braking appliances that are now in service, has been discovered. In the meantime, we wish to suggest that, until such a substitute has been found, you might do much to encourage the use of a better hand-brake rigging than is fitted to the majority of cars in this country. The desirability of such a contrivance is clearly set out by Col. Yorke in his report upon the Highgate accident, and is generally admitted.

It may be news to you to hear that a considerable number of tramway managers have discovered and are using a device which possesses many of the features which he recommends. We do not here propose to enter into a long dissertation upon the merits of this device (known as the Peacock brake) as, during the last 2½ years, it has been fitted to about 900 cars built in England alone, whilst in the U.S.A. it is in use on about 700 electric street railroads. As sole makers, however, of the brake in the British Isles, we cannot allow certain of your remarks upon the Halifax accident, which appear in the current issue of the ELECTRICAL REVIEW, to pass unnoticed.

You ask "Will the slack never take up?" We reply that the first claim for the Peacock brake is that it recovers slack chain quickly. One complete turn of the brake handle represents a "take up" of 4·7 in. of chain when wound in the usual way on a spindle of 1½ in. diameter; the same movement of the handle takes up 6 in. with our smallest brake, and more with our larger ones.

You next refer to "two or three ratchetings through 90° or so, to put on the pressure." Owing to our gearing (ratio 14 to 34) ratcheting becomes rarely necessary, and, what is more important, the required pressure may be applied by the arm, instead of by the weight of the body. The difference in the nicety of control is too obvious to need further comment.

Finally, a word as to the travel of brake chain corresponding to "just one more notch on the ratchet." Assuming that the ratchet wheel has 24 notches (which, we believe, is the maximum number ever used), for every notch the chain will move 0·196 in. if wound upon the usual spindle 1½ in. in diameter, and 0·055 in. if attached to the Peacock drum. This shows a variation in the range of working of nearly 3·6 to 1 in favour of the Peacock brake, and in the case of brake blocks biting insufficiently affords the motorman an opportunity of advancing his brake handle slowly and warily, with a light pressure, up to a total of three notches, whereas one notch (attained by a lurch of the body) might, with the ordinary spindle, be too much, and might lock the wheels.

The Consolidated Accessories Co.
J. McI. CATER.

London, E.C., *October 28th*, 1907.

[We were aware that the Peacock brake had been largely adopted both in America and in this country, and it has been described in our pages. Our correspondent should bear in mind that we expressly took a "purely hypothetical case," which was not supposed to represent the conditions obtaining at Halifax.—EDS. E.R.].

An Invidious Distinction.

Please note the enclosed cutting. I beg to state that in the first case the wiring was to be carried out by the Corporation, in the second case by a private contractor.

English law would not allow such picking and choosing, I should imagine.

J.O.B.B.E.R.Y.

Harrismith, O.R.C.,
October 7th, 1907.

ELECTRIC LIGHTING.

The Lighting Committee reported that Mr. Brady had received two applications for new services, viz.:—(1) Mr. J. S. Bonham's house, and (2) the Harrismith Carriage Works, the former requiring 250 ft. of cable, and the latter 220 ft. He estimated the cost of each service at £20. It was agreed to recommend that the service to Mr. Bonham's house be put in. With regard to the second application, in view of the fact that this is a place of business (differing from a dwelling house), and that there can be no guarantee that the service will be in use permanently, it was agreed to recommend that the service be granted on condition that a sum equal to 25 per cent. of the total capital cost is deposited by the applicant, this deposit to be returned in equal instalments over four years, provided the service is in constant use for that period.—*Harrismith Weekly Chronicle.*

[The asinine propensities of the law—even English law—are proverbial, and we are not sure that it could be successfully invoked in such a case as this. All consumers of *the same class* are to be treated alike, but the proviso is capable of a wide interpretation; and the power of imposing a condition such as that mentioned is generally possessed by municipal authorities. As the deposit amounts to only £5, it is not a serious consideration.—EDS. E.R.].

Metal-Core Flame Carbons.

The sender of the letter in your issue of October 11th, page 600, may be correct anent the tight fitting of the metal core into a separate core hole, as far as his observations have been made before the carbons were actually used.

The matter is slightly different when the carbons are actually burning in the lamps.

Zinc, of which such metal cores are generally made, is in itself a material the opposite of hard, and very easily loses its small degree of hardness when slightly heated, to which heating the cores are exposed whilst the arc lamp is burning, so that the curves in the form of which the wire is embedded into the separate core hole very easily stretch, and thereby the contact between the wire and the sides of the core hole ceases.

Furthermore, zinc oxidises very easily if air has access to it, as is the case when the zinc cores are fixed into separate core holes, and all the more if the carbons should at any time be exposed to damp storing, in which case the zinc core would be covered by oxide of zinc and the contact between core and carbon interrupted.

This drawback is effectually avoided if the zinc core is directly embedded in the carbon material, so that access of air between the core and carbon is perfectly obviated.

The inconvenience caused by fixing the core into separate core holes seems to have been observed by the Conradty Works also, as they have in many cases prepared their goods in the same way as the Planiawerke do—viz., by directly embedding the metal core in the carbon material.

H. Schuwer.

London, W.C., *October 18th*, 1907.

How it was Done.—We are indebted to a correspondent for a letter on this communication that appeared in our last issue. His suggestions will receive consideration.—Eds. E.R.

"Handy" Pocket-Knife.—The inventor of this device is requested to forward his address.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

New Speed Controller.

In fig. 1 we show a new speed controller without automatic features, which is being supplied by the Adams Manufacturing Co., Ltd., of Bedford, for use in conjunction with electric air propellers. It is claimed as a novelty, on account of its compactness, the total diameter being 5 in., and the depth from front to back 4 in.

Fig. 1.—Igranic Speed Controller.

Portable Electric Saws.

Messrs. Plutte, Scheele & Co., 18 and 19, Queenhithe, London, E.C., are just placing on the market their portable electric saws, which are particularised in their small catalogue. As is claimed by the makers, and shown in the accompanying illustrations, the saw is drawn through the wood, and there is no necessity for the workman to put his hand anywhere near the saw. When the saw is not cutting it rests at the back of the table protected by a guard. Owing to the fact that the saw is fitted complete with an electric motor, starting switch and steel-braided flexible cable, and can be wheeled about from one place to another, a very great amount of time is saved. It is made in several types for different purposes.

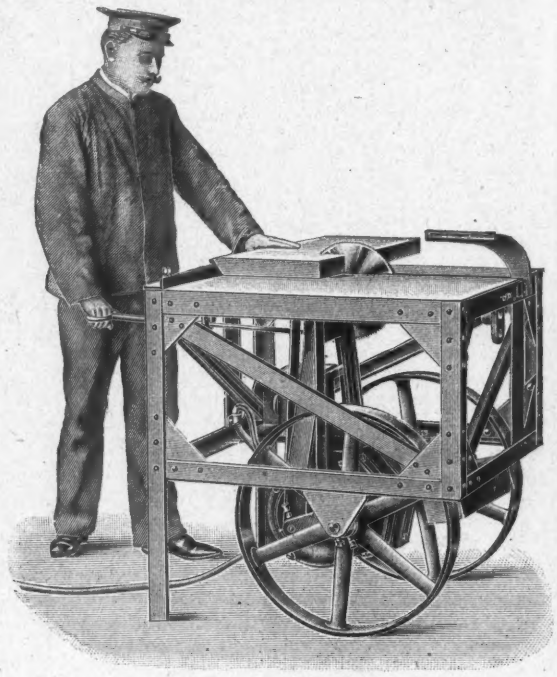


Fig. 2.—Type A Portable Electric Saw.

Fig. 2 represents the type A saw, suitable for cutting boards up to 3 in. thick with one cut either crosswise or lengthwise, and to take up to 21⅝ in. in width. In cutting crosswise the saw is drawn through the wood, which is pressed firmly against a rest at the front edge of the table. This arrangement, which has been patented, takes very much less power than the ordinary method of pressing the work against the saw. For cutting lengthwise, the front rest is turned down, and the saw is fixed at the back of the table. The wood is then pressed against the saw in the ordinary way. The table is drilled so that a wood extension table can be fixed if required.

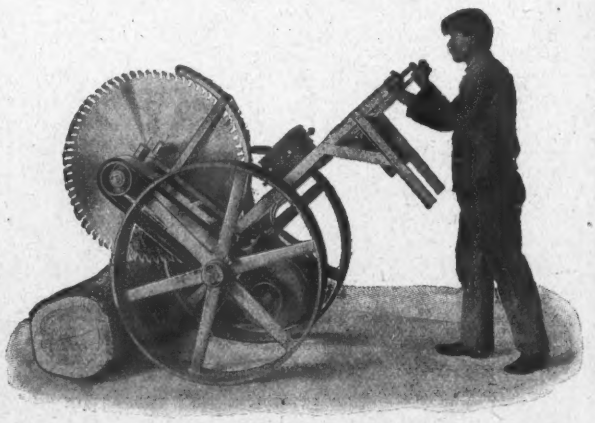


Fig. 3.—Type C Portable Electric Saw.

Type C (shown in fig. 3) is for cutting up large logs and trees as they lie in the yard. It can be wheeled and operated on any kind of uneven or soft ground, and time and labour are saved through trees not having to be handled. After the saw is started by means of the switch on the carriage, it is gradually lowered on to the tree by lifting the handles. Each machine is supplied with a special saw and 6 B.H.P. electric motor.

LEGAL.

J. Seward and H. W. Nightingale *v.* Metropolitan Electric Tramways, Ltd.

On Wednesday and Thursday last week, Mr. Justice Warrington in the Chancery Division of the High Court, had before him this case, in which plaintiffs claimed an injunction to restrain the defendants from erecting, or permitting to remain erected, certain electric standards on the roadway and footpath at Woodbery Grove, Finchley, and from trespassing upon the plaintiffs' premises, and for an order to remove the electric standards in question.

Plaintiffs are at present trustees of the second Birkbeck Permanent Benefit Building Society, and being owners of the road Woodbery Grove, Finchley, they in November, 1904, granted to the defendants the right to lay down certain tramlines along Woodbery Grove, but defendants had, without permission of the plaintiffs, erected standards and overhead wires for the purpose of their tramways, and refused to remove them. Plaintiffs said that unless the standards and overhead wires were removed their property would be depreciated, and they would suffer considerable damage.

Defendants alleged that they were entitled to erect the standards, as "tramlines" and all accessories, including standards and overhead wires used for the purpose of motive power. It was further alleged by the defendants that they would never have executed the indenture if they had not believed that the agreement included the standards.

His Lordship held that the defendants were entitled to put up the standards and equip the tramway. On the second part of the case, he held that Woodbery Grove was a private road owned by the plaintiffs, and that the defendants had been guilty of trespass. The trespass was small. He gave plaintiff 20s. damages. He gave no costs on this part of the case, but he gave the defendants costs on the part of the case in which they had succeeded.

B.E.T. Co. and Croydon Electric Tramways.

In the Chancery Division of the High Court on Saturday, Mr. Justice Parker heard a petition in the matter of the Croydon and District Electric Tramways (Extension) Act, 1903.

Mr. F. Thompson said this was a petition by the British Electric Traction Co., Ltd., for payment out of Court of moneys in the Court under the 85th Section of the Land Clause Act, as the purchase had been completed, the purchase money paid, and the bonds returned. He had an affidavit by the secretary verifying the statements in the petition.

His Lordship: Very well.

Winwick Asylum *v.* Hart Accumulator Co., Ltd.

The hearing of this case was commenced before Mr. Edward Pollock at the Manchester Assize Courts last July (see Elec. Rev., August 2nd, p. 169). It was a claim by plaintiffs for £1,200 damages for breach of contract. The hearing then stood adjourned for continuation in London after the Long Vacation, and it was accordingly resumed on Tuesday of last week before Mr. Pollock, at the Law Courts.

The case having lasted for about a week, Mr. Pollock gave judgment on Monday. He found that the sum of £200 the defendants had paid into Court was sufficient to meet the claim, and he accordingly gave judgment for the defendant company with costs. The plaintiffs would, however, have the costs up to the time of the payment of the money into Court. After that date defendants would have the costs.

Agincourt Steamship Co., Ltd., *v.* Eastern Extension, &c., Telegraph Co., Ltd., and Others.

This case came before the Court of Appeal, consisting of Lords Justices Buckley and Kennedy, on Saturday last, on the Appeal of the Eastern Extension, Australasia and China Telegraph Co., from an order of Mr. Justice Bray in Chambers.

Mr. Bailhache, for the appellants, said the order appealed from was one ordering that appellants should pay the plaintiffs the costs payable, or to become payable, by the plaintiffs to the defendants, the Great Northern Telegraph Co., Ltd., and ordering payment of the costs of the application. The action arose out of a hooked cable, and the case had previously come before the Court of Appeal on the question of the measure of damages some months ago.

In the course of a speech of some length, Counsel submitted that the appellants had acted quite reasonably in all they did, and that the learned Judge should not have made the order appealed from.

Without calling upon counsel for the respondents,

Lord Justice Buckley, in delivering judgment, said that this was an appeal from an order made by Mr. Justice Bray in Chambers, ordering that the defendants, the Eastern Extension Co., should pay the plaintiffs the costs payable, or to become payable, by the plaintiffs to the defendants, the Great Northern Co., and ordering payment of the costs of the application. The learned judge was asked to give leave to appeal from that order, and he refused it. Leave to appeal had been obtained from the Court of Appeal on the ground that the case involved a question of principle. The case here was that the plaintiffs sued the two companies—the Eastern Extension Co. and the Great Northern Co.—in respect of the loss of an anchor by fouling a cable at the bottom of the Yangtse Kiang River, and that the cable belonged to either of the two companies, the Eastern Extension or the Great Northern. The plaintiffs sued on joint contract, and also asserted that there was a joint cause of action. In both respects they failed, but they succeeded in maintaining a separate contract to the Eastern. Succeeding as against the Eastern Extension Co., the learned judge had ordered the Eastern Extension to pay the costs incurred and payable by the plaintiffs to the Great Northern Co. The Eastern Extension Co. said there was no jurisdiction to make that order. In denying that the liability was in them, the Eastern Extension Co. had asserted that it was in somebody else, and might have been in the Great Northern Co. Not knowing the exact state of the bottom of the river, did the plaintiffs act reasonably in joining the two companies as defendants? The learned judge had held they did act reasonably, and his order with regard to costs was not appealable, and, if it were, that Court would not review it. For these reasons, it seemed to him the order was right, and the appeal must be dimissed.

Lord Justice Kennedy concurred.

The appeal was accordingly dismissed, with costs.

Corporation of Wednesbury *v.* British Accumulator Co., Ltd.

Mr. Justice Phillimore and Mr. Justice Walton, sitting as a Divisional Court in the King's Bench Division, had this case before them on Saturday, October 26th, by way of an appeal from the decision of Mr. Justice Lawrence in Chambers in the matter of the appointment of an arbitrator.

Mr. Shearman, K.C., and Mr. Earnest Charles appeared for the appellants, the British Accumulator Co., Ltd., and the respondent Corporation was represented by Mr. Hansell.

The appellants asked their Lordships to reverse the order of Mr. Justice Lawrence, and to restore the order of Master Archibald, which was in their favour. The Corporation, it seemed, had entered into an agreement with a gentleman called Kramer, who traded as the British Accumulator Co. His business was subsequently carried on by a limited company, and the question arose as to whether they were bound to go to arbitration under the arbitration clause of the original agreement between Kramer and the Corporation.

Mr. Hansell maintained that the correspondence showed that there had been a novation.

Mr. Shearman submitted the contrary, and denied that the appellants were liable under the contract at all. Their case, he said, was that the Corporation charged with an insufficient current, and that that was the reason of the wearing out. He deprecated the institution of an expensive inquiry by an eminent engineer when there were legal points first to be decided, and when such an inquiry might not be necessary at all, and he said that the appellants were quite ready to accept service of a writ.

Mr. Justice Phillimore said it seemed at first blush that it would be better to put the case in the non-jury list in order to obtain a decision on the points of law raised. That course would not deprive the Corporation of any of their rights, because the action could be brought on terms arranged between the parties.

After some discussion, the case was adjourned till Friday.

Townsend *v.* Mayor, &c., of Swindon.

In the Court of Appeal on Monday before Lord Justice Vaughan Williams, Sir Gorell Barnes and Mr. Justice Bigham, in this case, an application was made by the defendants for a new trial in an action tried before Mr. Justice Walton and a special jury, at Bristol. The action arose out of an electric tramway accident at Swindon. The plaintiff had been a passenger on a tramcar which met with an accident, and at the trial the jury awarded him £8,000 damages. The case was settled on terms agreed upon, in which it was understood that the damages had by consent been reduced to £7,200, plaintiff to have both the costs of the trial at Bristol and of the appeal.

Ceramic Co. *v.* Leo Sunderland & Co.

This case which came before his Honour Judge Woodfall in the Westminster County Court on Thursday and Friday last week, raised a question of trade custom. The claim was for making electrical fittings which required special tools, and a counterclaim was made to recover the tools, plaintiffs claiming that they were entitled under a trade custom to charge defendants for the tools, but to retain possession of them.

Counsel for the plaintiffs opened that the parties to the action both carried on business in Victoria Street, Westminster, and there was no question as to ability to pay. Both were eminently respectable electrical firms, and were fighting a question of trade custom. Defendants ordered certain electrical fittings, and in order to make them, it was necessary to obtain special tools, for which plaintiffs had claimed £12. The order was by letter dated November 14th last, in which defendants stated: "It is understood that you credit cost of tools upon the receipt of further order." The order was executed and defendants paid, except the £12 for the tools. Plaintiffs sued for the amount, and defendants had admitted the claim and paid £12 into Court, but counterclaimed for possession of the tools.

The case for the defendants was that plaintiffs said these tools were necessary for making the caps and porcelain interiors ordered, and the price charged for the goods should be reduced by the amount charged for the tools, or the tools should be given to the defendants when they paid for them. The price of the tools had now been paid into Court, and defendants asked for the delivery, therefore, of what they had paid for.

Evidence was given on behalf of the plaintiffs that it was the

custom when giving orders for special taps to ask for special tools. The cost of such tools were added to the amount charged for the goods, and when the customer had given sufficient orders the cost of the tools was deducted. The making of these tools was a secret trade, and if they were parted with, it would be revealing a trade secret. The tools belonged to the customer, but the manufacturer of the goods for which they were necessary did not part with them. The customer had to pay for them, and when he had given sufficient orders he was recouped.

The JUDGE said it was quite clear what the bargain was between the parties, but it had been a little difficult to get hold of it. He saw the importance of the case. The contract was in the letter of November 14th; that was the basis of the contract, and the matter was really simple. He quite appreciated plaintiffs were in a position in which they could not let these tools leave their possession, because if they did they would part with a trade secret. It was clear that defendants contemplated they would never obtain possession of the tools, but, on the other hand, it was perfectly clear defendants gave their order on the understanding—on the agreement—that although they would never have the tools, they would have what they cost to make eventually. The contract was on the terms stated in the letter of November 14th, that they should in the future be credited with the cost. The date was not fixed. It was to be when there was a further order, and that order might be one merely given for the purpose of getting back the cost of the tools. When defendants gave that further order, and not till then, they would be entitled to be credited with the cost. He was quite convinced that the tools were never to become their property, but they were to pay for them, and when they had given the further order they were to be credited with the value. It was the value of the tools that remained the defendants'. It was clear defendants had to pay the value of the tools until they gave the further order, and it was impossible for him to say defendants could have delayed payment of the £12 beyond the date of paying for the goods for which the tools were necessary. The money for the tools accrued due and payable at the same moment the money was due for the goods manufactured. That disposed of the case, and by way of observation, he would say that if plaintiffs regarded the dealings with reference to these tools as of such paramount importance, he could not understand why they were so unbusinesslike as to leave it in doubt and difficulty as they did on the correspondence. He dismissed the counterclaim with costs.

BUSINESS NOTES.

Price Maintenance in Germany.—The Association of German Electricity Firms, at a meeting held recently in Berlin, announced that the manufacturing works forming this combination are briskly employed and orders are on hand in abundance. Notwithstanding this favourable situation there still exists a disproportion between the cost of production and the realised sale prices. Of raw materials only copper, which had advanced by 100 per cent. since 1904, has declined in recent times, but a reduction in the charges for other raw materials and of partly manufactured materials has not hitherto been made. The wages and salaries of workers and officials also necessitate constantly increasing appropriations. The Association adds that the percentage additions to prices of manufactures, which have been recorded in this journal during the past two or three years, afford no compensation for the higher cost of materials and of wages in the same period, and as a consequence the recent decline in copper will not allow of any reduction in the percentages added to manufacturing prices in the years in question.

Bennis Stokers.—Among orders recently placed with MESSRS. ED. BENNIS & CO., LTD., for their sprinkling stokers and compressed air furnaces are the following:—

Oswestry Electric Lighting and Power Co. (per Messrs. E. Bremner, Smith and Bremner, consulting engineers, Oswestry).	Two stokers and self-cleaning compressed air furnaces for 8 ft. diameter Lancashire boiler.
Long Eaton Urban District Council Electricity Works.	Three Bennis new patent coking stokers, with new patent self-cleaning compressed air furnaces, together with driving, shafting and electric motor, for B. & W. boiler.
Llangollen and District Electric Light and Power Co. (per Messrs. E. Bremner, Smith & Bremner).	One stoker and self-cleaning compressed air furnace for dry-back marine-type boiler.

Sherardised Conduits.—All conduit installations for high voltages—200 volts and upwards—must be electrically continuous throughout their entire length and permanently and efficiently connected to the earth in several places. The difficulty with enamelled tubing has been the enamel; its removal from the point of contact has been the first requirement, and this has resulted in the introduction of various methods of cutting through the enamel and putting the tube and fittings in electrical contact. Ordinary galvanising, whilst avoiding this disadvantage, has many drawbacks; incidentally, it clogs the threads, requiring re-screwing, and the occurrence of points and burrs on the insides of the tubes and fittings, and the unsuitability of the coating when bent, as well as the impossibility of applying it to close-joint tube owing to the unevenness of the tubing, have resulted in its use being effectually restricted.

A new method of galvanising conduits by the Sherardising process has now been introduced which seems to meet all the requirements whilst possessing none of the foregoing disadvantages. The resultant coating is always perfectly smooth and of even thickness, following the contour of the object treated with most faithful exactness, which means that screw threads will couple together after being galvanised by this process without further machining. It is also impossible for any roughness to occur on the inside of the tubes and fittings, and compared with ordinary galvanising, its rust-resisting powers seem much superior, whilst tubing can be bent to the smallest radius without affecting the protective value of the coating. The Sherardising method is equally applicable to butted or socket joint tubes and fittings, in which the continuity is preserved absolutely without the necessity for grip nipples or other clamping means.

The cost is very little more than that of the enamelled tubes, and the system certainly calls for careful consideration on the part of engineers and contractors who are interested in the perfecting of installation methods.

Italian Electrical Enterprise in 1906.—According to the *Board of Trade Journal*, H.M. Embassy at Rome have forwarded a copy of an abstract of notices respecting electrical enterprises authorised in Italy in 1906, issued by the Italian Ministry of Agriculture, Industry and Commerce, from which it appears that 239 plants were authorised during the year, of which 114 were extensions of installations already existing, and 125 were new ones with generating stations of their own. Of the latter, 73 employ hydraulic motor power, and 52 gas or steam motor power.

The more important plants, of which special mention is made, comprise the following:—

In Northern Italy, that of the Società Lombarda, Milan, for the conveyance and distribution of about 15,000 KW. in the Provinces Sondrio, Como and Milan; and that of the Società delle forze motrici dell'Anza, for the conveyance and distribution of about 7,200 KW. in the Province of Novara.

In Central Italy that of the Società mineraria ed elettrica del Valdarno, for the conveyance and distribution of about 400 KW. in the Provinces of Arezzo, Firenze and Sicira; that of the Società della Valnerina, for the working of a calcium carbide factory in the neighbourhood of Narni; and that of the Società per Imprese Elettriche di Roma, for the conveyance and distribution of about 6,000 KW. in the suburban zone north of Rome.

In Southern Italy that of the firm Zecca, Cauli & Co., for the conveyance and distribution of about 700 KW. in the Province of Chieti.

The following plants are also of importance in respect of the quantity of power transmitted and the extent traversed by the conducting wires:—

The conveyance of power from Pont Canavese to Rivarolo by the Società Manifattura de Rivarolo and San Giorgio Canavese; that from Bard to Carema of the Industrial Electrochemical Society of Pont Saint Martin; that of the Swiss Federal Railways for the electric system between Iselle and Briga; those of the Società Conti, from Vigevaro to Pavia and Novara; that of the Brescian Electric Society from Brescia to Cremona; not to mention the plants of the Società Bergamasca, of the Province of Bergamo; of the Società Officine Elettriche Genovesi, along the Riviera di Levante; that of the Società della Cellina, in the Provinces of Venice and Padova, and of the Società Marchigiana, for electrical firms in the Province of Ancona.

The abstract, which gives details in the case of each plant, such as the object of the plant, route of conducting wire, system of current, tension of line, nature and quantity of motor power, and power of electric generators, may be seen at the Commercial Intelligence Branch of the Board of Trade, 73, Basinghall Street, London, E.C.

Chinese Pumping Plant.—In his speech at the meeting of the Chinese Engineering and Mining Co., Ltd., on 28th ult., Mr. W. F. Turner, the chairman, made the following remarks concerning the electrical installations, to which we referred on page 698 of our last issue:—

"The electrical pumping and lighting plants at Tongshan and Linsi . . . were expected to have been in operation by the end of the year 1906, but their completion has been retarded by various causes. The installation at Tongshan came into operation on April 16th last, and that of Linsi on June 25th last. Bearing in mind the magnitude of these two installations, the whole of which had to be manufactured in Europe, shipped to Ching Wang Tao, transported thence to the mines and erected by Chinese labour under the supervision of Europeans, the accomplishment of this work within a period of about eighteen months leaves little room for dissatisfaction. The delays naturally gave rise to certain claims against the contractors, but these have been amicably settled, and the amount agreed upon will go in reduction of the cost of the plant. The installations are proving entirely satisfactory, and, thanks to their operation, our general manager estimates that the output for the current year will amount to about 1,200,000 tons. This, however, will not be the limit of our programme or of our capacity. We are advised that, as developments proceeds, the reserves of coal in the mines promise to prove much greater than has hitherto been anticipated."

Price Reduction.—MESSRS. W. T. HENLEY'S TELEGRAPH WORKS CO., LTD., have issued a circular to the trade notifying that, in consequence of the alteration in the price of raw materials, their present list prices (dated March, 1907) for rubber-covered wires and cables are reduced by 10 per cent., discounts remaining as before. The reduction took effect on October 24th.

Catalogues and Lists.—The Birmingham Electrical Fittings Co., Baskerville Works, Broad Street, Birmingham.—Circular describing, showing, and giving prices of their patent interlocked gas and water-tight switchgear.

Mr. G. Wuthrich, Maschinenfabrik Oerlikon, Oswaldestre House, Norfolk Street, Strand, W.C.—Four-page circular (in French) describing their small motor switch panels with patent interlocking arrangement, suitable for motor work where switchgear and fuses should be protected, and where such apparatus are handled by uninitiated persons. We are informed that the switch-box, which is shown in this list, and is claimed to be a compact and neat device, is much in favour in industrial circles.

The Bristol Electric Safety Lamp Works, 40, Great Smith Street, Westminster, S.W.—Catalogue (30 pages) containing tabulated particulars of their "plain cell" and wood-cased accumulators, ignition accumulators, ornamental safety lamps, also lamps for factory, gas works, ship, mining, fire brigade, submarine, photographic, carriage lighting, and many other branches of service. Some interesting lines in novelties for table decorations, stage ornaments and scarf pins, are also included, and are followed by some lines of dynamos, motors, and charging appliances and sundry accessories.

Mr. G. F. Vollmer, Dacre House, Victoria Street, Westminster, S.W.—Pamphlet relating to the Elektra insulating and impregnating varnishes supplied by the Internationale Elektra-Lack-Werke G.m.b.H., of Bruchsal (Baden), for whom he is the sole representative in this country.

The Electrical Co., Ltd., 162, Shaftesbury Avenue, London, W.C.—New 16-page publication, in which are shown and priced a variety of styles and designs of electric fittings shades in white and green-cased opal glass, crystal cut glass, enamelled iron, aluminium, and fancy silk.

Messrs. Julius Sax & Co., Ltd., 100, Charing Cross Road, W.C.—32-pp. price list containing illustrated particulars and prices of their electrical motor-car accessories, including batteries, battery-charging devices and hand lamps, garage lamps, car lighting lamps, testing instruments, ignition devices, and so forth.

Messrs. Wilkinson, Heywood & Clark, Ltd., Storer's Wharf, Poplar, E.—Leaflet relating to their anti-sulphuric enamels, air-drying insulating varnishes, paints, &c.

The Auto-Controller and Switch Co., Simplex Works, Vienna Road, Bermondsey, S.E.—A new show-card has been issued which forms an attractive advertisement of "Fluxite" soldering paste. Electrical stores and other sellers of the paste can obtain a copy on application to the company.

Messrs. Falk, Stadelmann & Co., Ltd., 83-87, Farringdon Road, London, E.C.—A number of new circulars have been issued for the trade as follows:—P426, "Climax" steel conduits and fittings; P412, revised price list of Leclanché batteries; P425, prices, &c., of trembling bells of improved medium quality; P421, HV tumbler switches; P424, self-replacing pendulum indicators; P432, "Codabso" electric cord absorber; and P418, showing various lines of flash lamps, small motors, &c., for the Christmas trade.

Messrs. Johnson & Phillips, Ltd., Charlton.—List No. 40, containing a number of well-executed illustrations, showing interior and exterior views of their "Magnet-Juno" flame arc lamps, and giving descriptive details and prices of same.

The Western Electric Co., Ltd., Norfolk House, Victoria Embankment, W.C.—We have received from this company a very neat and handy pocket-book, in which are calendars for 1907 and 1908, insurance coupons, and some tabulated data concerning electric conductors, which, together with descriptive matter concerning certain of the firm's manufactures, should be of service to the user.

Patent Amendment.—Notice is given of application for amendment of patent, No. 23,908 of 1897, for "Improvements relating to Railway and like Vehicles," granted to Edgar Peckham. Further particulars appear among our advertisements in this issue.

Martyn's Patent Watertight Fuse.—We regret that some confusion occurred in the lettering of fig. 8, page 681, in our last issue. The text should read:—"The latter are shown in fig. 8, passing through two porcelain blocks A and B into coned terminals D . . . . . nuts, which compress rubber washers C between the blocks."

Trade Announcements. — The Lawrence Patent Water Softener and Steriliser Co., Ltd., announce that their patent plant and apparatus are now being manufactured at larger works in the Midlands, and that their office has been transferred to 34, Victoria Street, Westminster, S.W. These alterations have been made in order to facilitate and extend the manufacture to meet the increased demand. We understand that considerable improvements (under new patents) have recently been made in certain types of the firm's apparatus, particularly one by which the sterilisation of contaminated water is effected entirely automatically.

Mr. D. C. Bate, of 40, Brazennose Street, Manchester, has been appointed sole agent for the counties of Lancashire and Yorkshire for the asbestos woven wire net resistances for controllers, regulators, electric radiators, and other similar purposes, manufactured by Mr. C. Schniewindt, of Neuenrade, in Westfalen.

As from yesterday's date, Messrs. Baxter & Caunter, of 86, Charing Cross Road, W.C., have relinquished the agency of the Perfecta Seamless Steel Tube and Conduit Co., they having been appointed sole agents for the Credenda Conduits Co., of Birmingham (proprietors, Tubes, Ltd.), for London and the South and East Coasts. Messrs. Baxter & Caunter will hold a very large stock of conduits, &c., at their Arthur Street warehouse ready for immediate delivery.

Messrs. E. Newman & Co. have opened an electrical business at 4, Cranbrook Road, Ilford.

The Perfecta Seamless Steel Tube and Conduit Co., Ltd., have opened offices and stores at 64, Victoria Street, Westminster, where large stocks of conduits and accessories will be carried. All their London and district conduit business will be done at the above address. They are no longer represented by any agent.

Messrs. W. J. Corse & Co., electrical engineers, Plymouth, have removed their business from 53, Union Street, to 45, Union Street.

The Stirling Boiler Co., Ltd., on 31st ult. removed their head office from Motherwell to 25, Victoria Street, Westminster, S.W. Their telegraphic address will be "Stirlinico, London," and their telephone numbers 559 and 822 Westminster.

Book Notices.—"The Patents and Designs Act, 1907." By J. Roberts and H. Fletcher Moulton. London: Butterworth and Co. 1907. 4s. net.

"Electric Power and Traction." By F. H. Davies. London: A. Constable & Co., Ltd. 1907. 6s. net.

"India-Rubber and its Manufacture." By H. L. Terry. London: A. Constable & Co., Ltd. 1907. 6s. net.

"Liquid and Gaseous Fuels." By V. B. Lewes. London: A. Constable & Co. 1907. 6s. net.

"Proell Steam Calculator." London: John J. Griffin & Sons, Ltd. 1907. Price 2s. 6d. net (one plate); 5s. net (three plates).

"Exposé Theorique et Pratique de l'Electricité Industrielle." By L. Lacon. Paris: Société d'Editions Techniques. 1907. Price 7.50 fr.

"Michigan College of Mines Year-Book, 1906-7." From the College, Houghton, Michigan, U.S.A.

"Handbuch für den Bau und die Instandhaltung der Oberleitungsanlagen elektrischer Bahnen." By A. Ertel. Hanover: Dr. M. Jänecke. 1907. Price 5 M.

"The Metric System." By F. M. Perkin. London: Whittaker and Co. 1907. Price 1s. 6d. net.

"Praktische Photometrie." By Dr. E. Liebenthal. Brunswick: F. Vieweg & Sohn. 1907. Price 19 M.

"British Standard Specification for Consumers' Electric Supply Meters (motor type)." London: Crosby Lockwood & Son. 1907. Price 2s. 6d. net.

"Memoirs of the College of Science and Engineering, Kyoto Imperial University." Vol. I, No. 3. Kyoto: the University.—This number contains, amongst many other original papers, the description of "Short Period Magnetographs," devised by Yoshisaburô Kashiwagi; and a paper on the "Theory of the Rotary Converter," by Tarô Otake.

"Bulletin of the Bureau of Standards." Vol. III, No. 3. Washington, U.S.A. Government Printing Office.

"Handbook of Electro-Plating, Polishing, Lacquering, Burnishing, Enamelling." Birmingham: W. Canning & Co. 1907.

"La Foudre et les Arbres." By Dr. E. Vanderlinden. Brussels: Hayez. 1907.

Germany.—The Schlesische Accumulatorenwerke Gesellschaft is the name of a new company which has just been formed at Kanth, near Breslau, to manufacture accumulators in accordance with the patents granted to Herr Max Schneider.

Australian Tariff.—According to the *Electrical Record* (Australia), a modification may be expected in the new tariff as far as electrical machinery is concerned. It appears that Mr. F. W. Clements, of the Melbourne and Geelong Electric Lighting and the Adelaide Electric Supply Companies, has successfully impressed upon the Minister of Customs that electrical machinery, turbines and generators should be divided into three divisions, as follows:—(1) Small articles which could not be made in Australia; these should be admitted free. (2) Larger articles which could not be made in Australia; on these a revenue duty only might be imposed; and (3) articles which could be made in Australia; these should bear the higher rate of duty. At present the duty for machinery, turbines, &c., is 32½ per cent. under the general tariff, and 27½ per cent. on goods which are the produce or manufacture of the United Kingdom.

Dissolutions and Liquidations.—Harry W. Cox, Ltd., 1a, Rosebery Avenue, E.C.—This company is winding up voluntarily with Mr. A. R. King Farlow, 4, King Street, Cheapside, E.C., as liquidator.

Portable Accumulators, Ltd.—Creditors must send particulars of their debts, &c., to the liquidator, Mr. C. L. Waltner, 28, Sheen Park, Richmond, by November 12th. A meeting will be held on November 26th, at 119, Victoria Street, S.W., to hear an account of the winding up.

W. R. Sykes Interlocking Signal Co., Ltd.—A meeting is to be held at 26, Voltaire Road, Clapham, on November 29th, to hear an account of the winding up from the liquidators, Messrs. W. Ives and W. R. Sykes, jun.

Chelmsford Electric Lighting Co., Ltd.—This company is winding up voluntarily.

Totnes Electricity Supply Co., Ltd.—This company is winding up voluntarily, with the directors as liquidators.

Furnace Fire Brick Co., Ltd.—Creditors must send particulars of their debts, &c., to Mr. Asa Smith, 111, Beeches Terrace, Keighley, the liquidator, by November 15th.

Rossendale Belting Co., Ltd.—The first meetings of creditors and contributories are to be held on November 13th, at Manchester

Bankruptcy Proceedings.—A. Matson.—At Stockton-on-Tees Bankruptcy Court on October 23rd, Andrew Matson, electrical engineer, Hardwick Terrace, Stockton, was examined on accounts showing liabilities amounting to £212, and a deficiency of £148. Debtor stated that he commenced business 18 months ago with a capital of £20, which was borrowed. He had never been solvent since he commenced, and he attributed his failure to having to commence business with borrowed capital, keen competition, and losses or contracts, through underestimating on account of inexperience. The examination was adjourned until October 30th.

Charge of Stealing.—At the County of London Sessions last week, Francis Millward, 32, an engineer, was sentenced to seven months' imprisonment in the second division for stealing metal fittings and electric cable from the County of London Electric Supply Co., Ltd. A fishmonger, named Floyd, was sentenced to nine months' hard labour for receiving the goods.

LIGHTING and POWER NOTES.

Blackpool.—The T.C. has applied for a loan of £5,000 for cable extensions, &c.

Bristol.—The Chamber of Commerce has considered the regulations drafted by the Home Office in connection with the generation, transformation, distribution, and use of electrical energy. The President pointed out that these regulations, if they became law, would tend to restrict and restrain the use of electricity in factories, and he felt that a protest ought to be lodged with the Home Office by the Chamber.

Church.—The U.D.C. has agreed to the suggestion of the Accrington Corporation to allow the latter body to apply for the necessary provisional order under the Electric Lighting Acts, for the supply of electrical energy for lighting and power purposes to individual consumers in its area, providing satisfactory terms can be arranged.

Clitheroe.—The town clerk reported to his Council on October 18th that he had received a communication from the B. of T. respecting the Electric Lighting Order, stating that as nothing had been done it devolved upon the Board to determine whether the order should be allowed to remain in force any longer. The clerk was instructed to write, asking for a 12 months' extension.

Continental Notes.—Italy.—The Hydro-Electrical Co., of Milan, has presented a petition to be allowed to use water-power from the various tributaries of the Masino River to generate 5,640 H.P. at a point where a fall of 423 m. is available; also for a fall of 708 m., where 2,835 H.P. will be available on the Tasso Bissolo River. It is further contemplated to construct a reservoir with a capacity of 8,400,000 cubic metres at an elevation of 2,000 m. above sea level, from which a large supply of power will be always available, the discharge finding its way into the Tasso Bissolo.

Lorraine.—The electric power plant at the works of the Société des Hauts Fourneaux Lorraine Aumetz-La Paix has recently been enlarged by the addition of a 1,500-H.P. gas engine and dynamo and three 1,500-H.P. steam turbines. At the La Paix works of the company, where a 1,500-H.P. gas engine and dynamo are already at work, a similar set of 2,000 H.P. is about to be put in operation.

Sweden.—H.M. Consul at Gothenburg, in a recent report on the trade of that port, states that amongst the more important resolutions of the T.C. in the past year, was one to erect an electrical works at a cost of about £320,000. By this resolution, the distribution, within the territory of the city, of lighting and power will become almost a municipal monopoly, and the electricity works will be in the same position as the gas works, tramways and waterworks. The department will also undertake the distribution of the electric current from the electrical works at Trollhättan.

A company has been granted a concession for 25 years for the supply of electricity for lighting and other purposes in Warberg at moderate rates, the power being obtained from the Yngeredsfors waterfall, situated about 22 miles east of Warberg; a steam power reserve will be erected to secure the supply in case of breakdown or shortness in the water supply.

Dusseldorf.—The municipality has decided to expend £37,500 on a station for its tramway system.

Co. Durham.—The Cleveland and Durham County Electric Power Co. has applied to the B. of T. for consent to use overhead lines from Port Clarence to Seaton Carew for the supply of energy for lighting.

Crewe.—A L.G.B. inquiry was held on October 23rd relative to the application of the T.C. for a loan of £3,000 for the extension of the electricity works and the erection of a sub-station. There was opposition on behalf of residents at Sydney, an outlying portion of the borough, who, whilst having to pay for public lighting, had not a supply of energy for private consumption. The inspector (Mr. F. H. Tulloch) suggested that as the undertaking was fairly successful, the T.C. might consider the advisability of extending the mains to Sydney.

Cromer.—A L.G.B. inquiry was held on October 23rd into the application of the U.D.C. for a loan of £8,000 for E.L. purposes, viz., mains connections to houses and meters, £4,600; plant extensions, £3,400. There was some opposition on the part of ratepayers.

Ebbw Vale.—Owing to the demand for electric energy purchased by the Council from the Ebbw Vale Steel, Iron and Coal Co., representations have been made to the vendors for a supplementary supply. This has been refused on some technical grounds, and the company has asked the Board of Trade to intervene in inducing the Council to furnish particulars of its scheme for the disposal of the additional supply. The Board of Trade replied to the effect that the matter in dispute did not appear to be one in which it had any authority to intervene. In face of this reply, the Council considered it had scored a distinct success, and the clerk was instructed to write the company asking what its intentions were relative to carrying out the agreement.

Edinburgh.—The Electric Lighting Committee has agreed to recommend the Council to supply energy to the forthcoming Scottish National Exhibition at a charge of 2d. per unit, with a minimum charge of £1,900. It was estimated that 328,000 units would be required both for power and lighting, and this is calculated to be equal to a charge of between £2,000 and £3,000. In connection with the Exhibition the electric light mains will be extended from Gorgie and Murrayfield to Saughton.

Horsham.—The U.D.C. has applied to the L.G.B. for a loan of £1,500 for electricity purposes.

London.—Hampstead.—The B.C. is to experiment with Osram lamps for street lighting. An exhibition is to be held in the town hall on November 5th, 6th and 7th next. The estimated expenditure on the electricity undertaking for the year ending March, 1908, amounts to £8,400, for which amount the L.C.C. will be asked to sanction a loan.

Southwark.—The engineer has advised that it is necessary to extend the Council's generating plant in order to meet the increasing supply, and that £14,500 would be required to provide new plant. The Committee, however, has recommended that no further extension of the undertaking be made at present.

Manchester.—Presiding at the meeting of the Electricity Committee on October 25th, Councillor Howarth stated that during the five years he had been its chairman, the sales of energy had increased from 10½ to 47½ million units, while the average price charged had fallen from 3·07d. to 1·73d. per unit. Taking the last six months as compared with the corresponding half of last year, the increase was 7¼ million units, or 36 per cent. In 1902 the Committee had a balance of £16,340 in reserve for renewals and general contingencies, and it had now risen to £154,058. Altogether the department occupies a creditable position, with the possibility of still further expansion.

Salford.—A loan of £3,000 for the extension of the E.L. mains to Prestwich has been applied for by the T.C.

South Africa.—The township of Matabele, in East Griqualand, has under consideration a water supply scheme to cost £14,000. In connection with this it is proposed to utilise the head of water which will be available, in a 50-H.P. Pelton wheel, driving a generator to supply 380 16-C.P. lamps. The population of the place is about 1,000.

South Wales.—A meeting of the power users in the Eastern and Western Valleys of Monmouthshire was held at Newport on Monday, at which it was resolved to form a company to carry on the Cwmbran power station of the South Wales Electrical and Power Distribution Co. The Cwmbran station and mains cost £161,000, and some £7,000 additional capital will be required to put the concern into working order.

Stoke-on-Trent.—The T.C. has applied for a loan of £9,400 for extending the E.L. cables to Fenton.

Stourbridge.—The clerk of the U.D.C. has been instructed to take such steps as may be necessary to obtain a completion of the transfer of the Council's Provisional Electric Light Order to the Shropshire and Worcestershire Electric Power Co., and the payment of the consideration undertaken to be paid by the transferees.

Ware.—In reply to a letter asking what steps were being taken to give a supply of energy to the town under the order of 1905, the North Metropolitan Electric Power Distribution Co. has informed the U.D.C. that owing to the stringent conditions of the money market it cannot see its way to incur the capital outlay.

Warrington.—The T.C. has received from the L.G.B. sanction to a loan of £3,010 for electricity purposes and for £4,165, portion of a former loan, to be utilised for boiler plant extensions.

Walthamstow.—In future a charge of £3 per lamp is to be made by the Electricity Committee to the public lighting account in respect of energy consumed by all new incandescent lamps erected, provided they are fitted with tantalum lamps of 46 C.P. A report by the electrical engineer as to the lighting of the Sanatorium and the provision of meters is under consideration. In the central library, tantalum lamps are to be substituted for incandescent in the news room.

TRAMWAY and RAILWAY NOTES.

Accrington.—The newly-laid section of the Accrington electric tramways in Burnley Road was inspected by Lieut.-Col. Druitt, of the B. of T. on October 25th. The route was opened to the public on Saturday morning.

Belfast.—At the weekly meeting of the Tramways and Electrical Committee, the projected Ligoniel extension came up for discussion, and the Committee passed a resolution recommending the completion of the extension within the two years. A resolution was also passed approving of a Bill being brought in the House of Commons to confirm the purchase of the Whitewell and Cavehill tramway.

Bradford.—Lieut.-Col. E. Druitt, reporting on the accident which occurred on July 21st, states that there was no doubt that the brakes were in good order when the car started to run away, but that the leading axle broke, and as a result the hand-brake was rendered useless, and to a large extent the electric brake as well. He thinks, however, that had the slipper brake been more fully applied at first, the car would not have run away through the axle breaking. He is of opinion that for cars on steep gradients there should be a mechanical slipper brake that can be applied practically instantaneously, as once a car gets out of control on a steep gradient it is almost impossible to stop it with the brakes now in ordinary use.

China.—An agreement between the Tientsin City Electric Tramway and Lighting Co., Ltd., and the Japanese municipal authorities for the extension of the tramway system through the Japanese concession has been signed, and the work of laying the lines will be proceeded with at once.

Continental Notes.—ITALY.—The Administration of the Italian State Railways has everything prepared for the immediate conversion to electric traction of the Milan-Lecco section. This will subsequently connect up with the Valtellina system, and will be arranged to work on the Ganz system. Before long it is intended to try an experiment on the section between Lecco and Calolzio, to establish whether the Ganz or Westinghouse system is the more suitable.

Work has been commenced on the electric tramway between Salerno, Cava and Pompeii by the Electric Tramway Co., of Salerno, which has a capital two million lire, one-half of which is paid up. The length of line is 30 km., and the towns of Vietri, Cava, and other important places are along the route.

The project for the Pallanza Fondo Toce Tramway, which has been sought by the Commune of Pallanza in order to get connection with the St. Gothard and Simplon Railway, has been passed by the Council of Public Works, and the concession will be immediately granted, the construction being along the public road.

A company has just been formed in Genoa with the title La Societa per la Ferrovia Elettrica Genova-Caselli-Busalla, with the object of constructing an electric railway between the places named.

VIENNA-BUDA PESTH RAILWAY.—A telegram from Buda Pesth states that Herr Kampe, of Hamburg, and Herr Müller, of the Dresden Bank, who apparently represent German interests, have just laid before the Ministry of Commerce a new scheme for the establishment of an electric railway between Buda Pesth and Vienna. The project is to be financed by a banking syndicate, and is estimated to involve an expenditure of £10,000,000. It is proposed under the scheme to lay down six double tracks *via* Gran, Komorn and Pressburg, where a connection would be formed with the projected electric railway between Pressburg and Vienna.

MILAN.—On the 22nd ult. the first part of the high tension, 16,000-volt cable was laid in the Camp conduits, under the direction of Mr. James F. Cummings and Mr. Douglas Wells, of Brussels. We understand that this is the first time that high tension cable has ever been laid, on the Continent, in conduits.

SWEDEN.—In a recent report, H.M. Vice-Consul at Helsingborg states that the first electrically-driven railway in Sweden is now in operation carrying goods and passengers by the line Helsingborg-Raa-Ramlösa.

Glasgow.—The Tramways Committee of the T.C. has under consideration the question of introducing mechanical haulage for street-sweeping machines, instead of horse haulage as at present, as the Tramways Department may undertake to sweep all the tramway tracks within the city nightly, by electric power.

Gloucester.—A special meeting of the City Council was held last week to receive the report of the Mayor (Mr. S. Aitken) and Councillor Harland-Bowden, who had been appointed a Special Committee to make inquiries whether the Gloucester Light Railways could be let on lease on terms beneficial to the city. Last year the working of the tramways necessitated a 5½d. rate to help pay the capital charges. The report of the Committee gave details of an offer that had been made by a company to take over the light railways on a 20 or 25 years' lease, and the Committee was of opinion that the undertaking might be leased on terms beneficial to the ratepayers. The Mayor said if the Council decided to lease, the city would be relieved of renewals and the cost of maintenance and general up-keep. The citizens would have a service equal to that now given, and at the outside the rate to make up interest and repayment of loans would not be more than a 1d. in the £, as compared with 5½d. for the last two years. Dr. Waddy moved that the report of the Special Committee be relegated to the new Tramways Committee to be elected on November 9th, but that before any decision as to leasing is arrived at, a poll of the citizens be taken. An amendment was moved that it was in the best interests of the ratepayers that the ownership and control of the tramways should remain vested in the citizens. This was carried by 19 votes to 13.

Halifax.—As a result of the Coroner's inquest following the recent run-away accident on the Sowerby Bridge section of the Corporation tramways, the jury returned a verdict with a rider blaming the Halifax authorities for sending out a car with different type controllers at the ends. They also recommended that cars on the route in question should have three men in charge, a driver and conductor to take charge of the running of the car, and a third man to collect fares. In the course of the evidence it was shown that a loose connection had been found in the controller in use, and that the wire had been displaced while current was passing. Owing to this the electric brake-power would be insufficient to hold the car on the gradient. The car was fitted with two 35-H.P. motors, two controllers of different type, wheel, slipper and electric brakes. According to the driver, when the car began to slip back the power went off, he first locked and then released the wheels by the hand-brake, then applied the electric and slipper brakes with no effect. The current coming on again, he reversed the motors forward and then the trolley broke off. Some confusion appeared to have existed in the driver's mind due to there being two types of controller, but owing to the loose connection, the controller would in any case not have acted properly. As to the failure of current, it was suggested that a short-circuit caused by the loose wire might have brought the circuit-breaker out at the power station, and it was stated that during the year October, 1906-October, 1907, the switches for the centre of the town came out some 1,300 times, and the switch controlling the section where the failure occurred 900 times. The latter switch was supposed to carry a load of 750 amperes.

The Tramways Committee, as a sequel to the above accident, has just passed a resolution that the Board of Trade be requested to nominate a mechanical engineer and electrical engineer to sit together for the purpose of inquiring into and reporting upon the structural features of the cars, types of brakes, and the working of the same on the Halifax system, and what improvements, if any, are desirable for ensuring more effectively the safety of the travelling public.

Japan.—An official charter has been given to the Yokohama Electric Railway Co. to construct an electric line from Yokohama to Kamakura.

Live-Rail Accidents, 1904-6.—A Board of Trade return giving the number of persons killed and injured on electrically-equipped railways in this country during 1904-6, and down to the end of August this year, through coming into contact with "live" rails, has just been issued. In the whole period 16 persons were killed and 71 injured. The fatalities included four railway servants and 12 trespassers; and the injured, 40 servants, one passenger, five persons on business, and 25 trespassers. The largest number of casualties occurred on the North-Eastern system—namely, eight killed and 28 injured—the next in order being the Lancashire and Yorkshire, with five killed and 19 injured. The return for the whole period for the London underground lines is as follows:—District, two killed, nine injured; Metropolitan and Great Central Joint, one killed, one injured; Metropolitan, six injured; Metropolitan and Great Western Joint, two injured; City and South London, Great Northern and City, and Metropolitan and District Joint, one injured each.

Liverpool.—The City Council on the 23rd ult. agreed to a new tramway route in the north-end district. Sir Charles Petrie (chairman of the Tramways and Electricity Power and Lighting Committee) moved that application be made to the B. of T. for a provisional order for the construction of a line of tramways from the "Black Bull" *via* Walton Vale, Sandhills Lane and Derby Road to its junction with Stanley Road, and this was agreed to.

London.—WEST HAMPSTEAD.—A serious collision occurred at this station between two Metropolitan electric trains on Saturday morning last. A thick fog hung over the district, and through some cause, unascertained at the time of writing, an express train was allowed to run into the rear of a stopping train standing in the platform. The motor-coach of the moving train ploughed through the last vehicle in the stopping train, three persons being killed and 12 injured. A B. of T. inquiry was opened by Major Pringle on Monday last, into the circumstances of the accident. It is noteworthy that this is the first fatal collision which has occurred between Metropolitan trains since the railway was opened.

L.C.C.—The B. of T. has intimated that the adoption of the proposed G.B. surface-contact system on the Mile End and Bow

Road route does not appear to present any serious obstacle in the way of future arrangements for through running; presumably the Council will now proceed with the reconstruction of the route.

Four deputations, all in opposition to the proposed tramway route from West Norwood to the Crystal Palace and in favour of another route, were received last week by the Highways Committee.

The greater portion of Tuesday's meeting of the L.C.C. was devoted to a discussion of the tramway accounts for the financial year ended March 31st, 1907. The accounts, which were published in these columns two or three weeks ago, show on paper a surplus balance of £9,674 for the year. Mr. A. F. Buxton, Chairman of the Finance Committee, stated that if 1d. per car-mile was calculated for renewals, that sum had not been provided by a long way, and the accounts were not bearing their proper liability. The low fares and the renewals fund would, he declared, exhaust any profits arising from the tramways for many years to come. Mr. W. Thompson, Chairman of the Highways Committee, mentioned that it was intended to set aside as much as possible for the renewals reserve fund in the future. After further discussion the accounts were approved.

Paddington.—It is stated that the B.C. intends to apply to Parliament next Session for powers to extend the Harrow Road tramways from the existing terminus at the Canal Bridge to the junction of the Harrow Road and the Edgware Road. If this extension is carried out, it will bring the passengers almost opposite the Edgware Road Station of the Bakerloo tube.

Manchester.—As a result of the agitation which has lately been going on in Manchester respecting the working of the tramway system, Councillor Hynes has given notice that at the next meeting of the City Council he will move for the appointment of a special committee to inquire into and report upon the administration and management of the financial and working departments of the Tramways Committee.

The Tramways Committee has given orders for a further 50 of the small type of cars to be fitted with top covers. The Committee has resolved to proceed by way of provisional order for authority to construct the proposed new tramway along Princess Road, and to acquire lands from Lord Egerton.

Middlesex.—At the meeting of the County Council on October 24th, the Light Railways Committee brought forward a recommendation in favour of the county solicitor being instructed to give the necessary Parliamentary notices for a Bill in the next session of Parliament, for a tramway from Cricklewood to Harrow Road, the Metropolitan Electric Tramways to pay the preliminary expenses, which are not to exceed £150. The chairman of the Committee (Sir Francis Cory-Wright) withdrew the report and recommendation, stating that, owing to obstacles placed in the way by other Committees, it would be impossible for the notices to be given in time for the ensuing session of Parliament.

South Lancashire.—We understand that the Lancashire United Tramways Co. has just inaugurated a parcel-carrying service on various sections, and appointed numerous collecting agents.

West Ham.—Mr. H. E. Blain, the manager of the Corporation Tramways, has reported to his committee that 83 per cent. of the motormen and conductors in the service of the Council who are eligible for benefits under the recently-adopted bonus scheme have earned bonuses during the past quarter.

TELEGRAPH and TELEPHONE NOTES.

Antwerp.—The Telephone Exchange was completely destroyed by fire on Tuesday morning.

Canada.—As the result of the success of the C.P.R. telegraph operators in their agitation for better terms, the operators of the Grand Trunk Railway are demanding similar benefits, and a strike is threatened. About 800 operators are concerned.

Leeward Islands.—The Colonial Report for 1906-7 states in regard to the telephone service that there are 161 instruments and 290 miles of wire in Antigua; 92 instruments and 254 miles of wire in St. Kitts; and 110 instruments and 325 miles of wire in Dominica. Receipts and expenditure in Antigua were £787 and £667; in St. Kitts, £419 and £552; and in Dominica, £503 and £598 respectively.

Natal.—The Postmaster-General of Natal in his annual report dated December 31st, 1906, states that the revenue for the financial year ending June, 1906, from all classes of telegraphic and telephonic business, amounted to £61,686, being an increase of £1,802 over the previous year. In addition to this the sum of £13,300 represents the value to the various Government departments, of services for which no charge was made. The telegraph receipts amounted to £6,826; the charges collected by the Eastern Telegraph Co. for cables to and from South Africa exceeded £300,000, and in terms of the agreement the annual subsidy was reduced to £775.

Photo-Telegraphy.—Recent experiments with the Korn system of transmitting portraits by telegraph have resulted in the successful transmission of photographs between Paris and Berlin, a distance of about 800 miles.

Post Office Telephone Charges.—In a letter to the *Times* of October 29th, a Post Office telephone subscriber complains of repeated overcharges on the message-rate system, not only in his own case, but in others. While we agree that the message-rate system is undoubtedly the right one to adopt, we feel that the frequent recurrence of complaints such as this will prove a very serious deterrent to its introduction—more serious, perhaps, than the opposition of the large users. Is it possible that calls which do not mature are improperly recorded by the operators?

Telegraphic Interruptions and Repairs:—

Cables.	Interrupted.	Repaired.
Curacao-Coro Curacao-La Guayra Curacao-Maracaibo } Closed..	Jan. 12, 1906 ..	..
Tarifa-Tangier	Jan. 18, 1904 ..	..
Port Arthur-Chifu (Closed)	Mar. 9, 1904 ..	..
Garachico-Santa Cruz	July 12, 1906 ..	..
Las Palmas-Arecife	Aug. 18, 1906 ..	..
Brest-Dakar	July 22, 1907 ..	..
Midway Island-Guam	Sept. 22, 1907 ..	Oct. 22
Pernambuco-Ceara	Oct. 9, 1907 ..	..
Guernsey-Jersey	Oct. 19, 1907 ..	..
Landlines.		
Puerto-Barrios	Aug. 2, 1909 ..	..

Telegraphists' Strike in the U.S.A.—The strike seems to have utterly collapsed; many of the operators have applied for reinstatement, and the president of the union, S. J. Small, has been called upon to resign his office. It is reported that the Postal Telegraph Co. favours the organisation of a Postal Telegraph Employés' Association for the benefit of both employers and operators. Serious delays are still reported in the transmission of both public and private messages.

Telephony between Germany and Denmark.—A new submarine cable has recently been laid between the German island of Fehmern and Laaland, Denmark, representatives of both countries and of the Felten and Guilleaume-Lahmeyer works being on board the cable steamer during the work of laying. The object of the cable is to establish a direct line between Berlin, Lubeck and Copenhagen, which has been rendered necessary in consequence of the constantly increasing telephonic traffic between Germany and Denmark. It is stated that the new telephone cable has a total length of 19·3 nautical miles. The old cable now serves for telephony between Hamburg, Berlin and Copenhagen. The expenditure on the work has been borne equally by the two countries. The cable increases to five the number of German-Danish submarine cables for telegraphy and telephony, all of which have been laid in the past 30 years.

West Africa.—Cable communication with the Niger has been very unsatisfactory of late. The African Direct Telegraph Co. states that the delays were probably due to interruptions in communication by the Government landlines.

Wireless Telegraphy.—The ss. *Lituania* was recently wrecked at Skillinge, near Stockholm, with 864 persons on board; being equipped with the Poulsen apparatus, she was able to open communication at once with the Lyngby station of the Amalgamated Radio-Telegraph Co., and to summon assistance. Communication has been maintained throughout the salvage operations, and the system has demonstrated its utility conclusively.

Wireless Telephony.—Arrangements are in progress for equipping a number of British warships with wireless telephone apparatus on the Poulsen system, supplied by the Amalgamated Radio-Telegraph Co.

CONTRACTORS' COLUMN.

Openings for New Business.

ALDERSHOT.—New nursing sisters' quarters at Cambridge Hospital. H. B. Measures, Director of Barrack Construction, War Office, Pall Mall, S.W.

New secondary school for Hants C.C.

ALLOA.—New bottle works in Kelliebank district for Geo. Younger & Sons, brewers.

ASHTON-IN-MAKERFIELD (Lancs.).—New weaving mill for the Makerfield Mill Co., Ltd. J. B. & W. Thornley, architects, College Chambers, Wigan.

BARNSLEY.—New Y.M.C.A. premises, with three shops, in Eldon Street. Trustees and committee of the Y.M.C.A.

(Monk Bretton).—New Council School at Smithres for the West Riding of Yorks C.C. E. W. Dyson, architect, 10, Regent Street, Barnsley.

BARRY (Glam.).—Alterations and additions to Holton Road Council Schools. G. A. Birkenhead, architect, Caledonian Chambers, St. Mary Street, Cardiff.

BERKHAMSTEAD.—New church, All Saints, to seat 600. C. H. & N. A. Rew, architects, Berkhamstead.

Bungalow, lodge and residence on Woodcock Hill Estate for Mr. Tetley.

BINGLEY (Yorks.).—Proposed new training college for teachers, for th U.D.C.

BOLTON.—Proposed new school for Tonge district. F. Wilkinson, Director of Education, Bolton.

BOURNEMOUTH (Pokesdown).—New church, St. Andrew (£8,550). J. D. Scott & Son, 2, Dean's Yard, Westminster, S.W., and Chas. T. Miles, Bournemouth, architects; Trask & Son, builders, Norton, Stoke-under-Ham, Somerset.

CAPEL (Sussex).—Alterations to Church of England Schools. W. T. Barlow, architect, 4, Queen Street Place, E.C., and Arcade Chambers, Bognor.

CARLISLE.—Important extensions to Holme Head Mills for Ferguson Bros., woollen manufacturers.

(Warwick).—New school and house for Cumberland C.C. Joseph Forster, architect.

CARSHALTON.—Houses (15) on Westmead Estate. Harris & Son, builders.

CATERHAM.—New Wesleyan Church (£2,500).

CHICHESTER.—Important alterations at the General Post Office for H.M. Office of Works.

CLECKHEATON.—Extensions at mills in Hunsworth Lane. Wilson Cobbett, Ltd., owners; Howorth & Howorth, architects, Cleckheaton.

COLCHESTER (Alresford).—New schools for the Governors of Perin's Grammar School.

COLLYWESTON (Northants).—New elementary school.—J. B. Corby & Son, architects, 15, All Saints' Place, Stamford.

COLNE (Lancs.).—Alterations and extensions at Stone Bridge Mill (weaving) for Messrs. H. Broughton & Co.

COMPSTALL.—New premises for Compstall Co-operative Society. Secretary.

COWDENBEATH (Fife).—Drill Hall. Gillespie & Scott, architects, St. Andrew's, Fife.

CREWE.—Conversion of houses into business premises for Crewe Co-operative Friendly Society, Ltd. G. E. Bolshaw, architect, 2, Mill Street, Crewe.

CROYDON.—Public Baths enlargement (£8,000, lighting £80). G. F. Carter, borough engineer, Town Hall, Croydon.

DONCASTER (Scunthorpe).—New hotel. Tennant & Collins, architects, Pontefract.

(Brodsworth).—Establishment of colliery village, comprising 1,000 houses, club, library, and refreshment rooms. Mr. Soutan, architect, London.

DORCHESTER.—New Latrines and alterations to the girl's school. J. Feacy, architect, South Walks, Dorchester.

DUNDEE.—Residences in Blackner's Road, Leven Street. A. Speed, Salisbury House, Dundee.

DUNFERMLINE.—New hall for St. Leonard's Church.

EAST STONEHOUSE (Devon).—Electric installation at the Town Hall buildings for the U.D.C. C. H. Trounce, surveyor, Town Hall, East Stonehouse.

EBBW VALE (Mon).—Additions to Bethesda Presbyterian Chapel. H. Batten, architect, Dalmeny House, Ebbw Vale.

EDINBURGH.—Concert hall at Saughton Park. J. D. Gibson, surveyor, 60, Frederick Street, Edinburgh.

ENNISCORTHY (Ireland).—Reconstruction of Market House Building. P. J. Shaw, secretary to the Enniscorthy Urban Technical Instruction Committee.

FRIERN BARNET.—School (£4,888). H. G. Crothall, architect to Middlesex Education Department, Guildhall, Westminster. Mattock Bros., Wood Green, builders.

GERRARDS CROSS (Bucks.).—Banking premises. London and South-Western Banking Co., owners.

Extensive alterations and additions to Aldbourne Manor. J. Bell White, owner.

GLASGOW.—New block at Belvidere Hospital. Office of Public Works, City Chambers, 64, Cochrane Street, Glasgow.

GREENOCK.—Important additions to the Academy. Boston, Menzies & Morton, architects, Greenock.

HUDDERSFIELD.—Extensive premises for the Midland Railway Co. C. Murgatroyd & Sons, Ltd., builders, Woodbine Works, Idle, Bradford.

ISLEWORTH.—New Roman Catholic Church in Twickenham Road.

LEAMINGTON SPA (Cubbington).—New club premises for the Manchester Unity of Oddfellows. F. P. Trepess, architect, 1, Church Street, Warwick.

LEEDS (Roundhay).—New Congregational Church in Shaftesbury Avenue. W. H. Beevers, architect, 26, Bond Street, Leeds.

LEIGH-ON-SEA.—New Baptist Church (£1,700).

LEWES.—Important extensions at the Workhouse for the B.G. (£1,564).

LLANELLY.—New Wesleyan Church in Glenalla Road (£2,000).

LONDON (Hackney, N.E.).—New tramcar shed in Mare Street, for the L.C.C. W. E. Riley, architect to the L.C.C., County Hall, Spring Gardens, S.W.

(Millwall, E.).—Additions to factory in West Ferry Road, of C. & A. Morton, provision merchants, &c.

(Marylebone).—Rebuilding block of property in Seymour Place. F. W. Hunt, agent to the Portman Estate, 30, York Place, W.

(Dulwich, S.E.).—House and garage. Muir & McIlwraith, 4, Raymond's Buildings, W.C., architects.

(Southgate).—School (£7,847). H. G. Crothall, architect to Middlesex Education Department, Guildhall, Westminster; Mattock Bros., Wood Green, builders.

(Wood Green).—School (400 children). W. P. Harding, clerk to Urban District Council, Wood Green, N.

(Camberwell).—Flats upon site of Nos. 41, 42, 43, Camberwell Green. W. H. Woodroffe, 57, Lincoln's Inn Fields, W.C., architect.

(Stockwell).—Installing electric light in South-Western Hospital (£4,000). W. T. Hatch, engineer-in-chief of the Metropolitan Asylums Board, Embankment, E.C.

(East Ham).—New church in Burgess Road (£2,000).

(Homerton, N.).—Workshop at rear of 1 and 3, Urswick Road for W. Silk & Son, 13, High Street, Homerton, builders.

MANCHESTER.—Large new block at Owen's College. W. A. Peters & Son, builders, Rochdale.

(Gorton).—New Church "St. George's." C. K. and T. C. Mayor, architects, John Dalton Street, Manchester.

MARGATE.—Hotel and business premises in Northdown Road and Lyndhurst Avenue. Moodey & Chrisfield, architects.

MONTROSE.—Villa for W. Ross, at the Mall. John Burnett, builder, Montrose.

MUMBLES (Glam.).—Bungalow residence for T. J. Radcliffe. A. Leslie Lewis, architect, Rock House, Mumbles.

NORMANTON.—New school for West Riding C.C. J. Vicars-Edwards, county architect, County Hall, Wakefield.

POLLOKSHAWS (N.B.).—Rebuilding Sir John Maxwell School in Bengal Street (£12,000).

PONTEFRACT.—Alterations to Carleton Provided School. J. Vickers-Edwards, county architect, County Hall, Wakefield.

PORTSMOUTH (Southsea).—Rebuilding of business premises. Argylls Hampshire, Ltd., 41, Castle Road, Southsea, owners.

Important extensions to the tramway offices for the T.C. Borough tramways engineer, Vivash Road, Fratton Grove, Portsmouth.

PRESTON.—Building scheme for the Methodists (£12,000).

PUDSEY.—Proposed new Secondary School in Richardshaw Lane for the T.C.

PURLEY.—New Baptist Lecture Hall (£1,500).

RAMSGATE.—New General Post Office.

READING.—Residence, Manor Farm, for the T.C. (£1,150).

RINGWOOD (Hants.).—Mansion on Picket Plain for Lord Lucas.

ROCHDALE (Castleton).—New Corporation Baths (£10,000).

ROCHESTER (Wouldham).—Rebuilding Waterman's Arms Hotel. E. W. Filley, builder, Gundulph Road, Chatham.

ROYTON (near Oldham).—New card room and warehouse accommodation for the Shiloh Spinning Co.

RUGBY.—New Sewage Purification Works for the U.D.C. D. G. Macdonald, surveyor to the U.D.C., Rugby.

SABDEN.—New weaving shed (600 looms),

SALFORD.—New United Methodist Schools and Hall (£4,000). Scott & Fenton, builders, Salford.

Extensive additions to the Royal Hospital (£70,000).

SHEFFIELD.—Proposed new Methodist Chapel at Chapel-en-le-Frith.

(Penistone).—Additions and alterations to Langsett Provided School for the West Riding C.C. J. Vickers-Edwards, county architects, County Hall, Wakefield.

(Penistone).—Extensions to Cubley Brook Brewery. J. Allott, architect.

(Thurlstone).—New council room, offices, caretaker's house, and outbuildings for the U.D.C. J. Wadsworth, clerk to the U.D.C., Thurlstone, near Penistone, Sheffield.

(Thorpe Salvin).—Additions and alterations to Thorpe Salvin Provided School. J. Vickers-Edwards, county architect, County Hall, Wakefield.

SHORTLANDS.—New Congregational Mission Hall. G. Baines & Son, architects, Clement's Inn, E.C.

SKETTY (Glam.).—Extensions to St. Paul's Church. G. Moxham, architect, 39, Castle Street, Swansea.

SKIPTON.—New public schools. Jas. Hartley, architect, Swadford Chambers, Skipton.

SOUTH BANK (Yorks).—New Unionist Club for the South Bank and District Unionist Club Building Committee. Fred Walshaw, architect, 59, Lorne Terrace, South Bank (Yorks); T. W. Wade, secretary of the club.

SURBITON.—New Special Subjects Centre for Surrey C.C. (£1,260).

TAMWORTH.—New factory at Bolehall. Thos. Cook & Sons, Ltd., wholesale clothing manufacturers, Tamworth, owners.

TAUNTON.—New post office in North Street.

TAYPORT (Dundee).—Shop and dwelling houses for Peebles Bros., merchants, Dundee.

UPPERMILL (Saddleworth).—Conversion of woollen mill into a ring spinning cotton mill.

WADEBRIDGE.—New schoolroom at Burlawn in connection with the Wesleyan Chapel.

WAKEFIELD (Stanley Ferry).—New County Council Schools. J. Lane Fox, architect, Bond Street, Dewsbury.

WALLINGTON (Surrey).—New Roman Catholic Church.

WALSALL.—Important extensions to Manor Works, Sandwell Street. Birmingham Dental Supply Co., Edmund Street, Birmingham owners.

WHITBY.—Large residence at Eastrow. A. Spencer, Sheffield, owner; T. Dowson, architect, Whitby.

WIMBLEDON.—Semi-detached houses in Durham Road, Raynes Park. Belfrage & Saville, architects, 27, Chancery Lane, London, W.C.

WOLVERHAMPTON (Wightwich).—Tennis temple for Sir A. Hickman, Bart. W. P. Lavender, architect, Wolverhampton.

WOODSEATS.—Additional departments at the Council School to accommodate 840; also cookery and laundry centre.

WREXHAM (Brymbo).—Important additions to the Vicarage. Robert Williams, builder, High Street, Brymbo.

Hospital Lighting.—Points where Electricity Gains. — At the fortnightly sitting of the Metropolitan Asylums Board on Saturday, the Hospitals Committee reported that the gas mains at the South-Western Hospital were defective, and they had considered the question of substituting electricity for gas. Dr. Craiger, the medical superintendent, strongly urged lighting by electricity for the following reasons:—(*a*) It would provide a better illumination of the wards, most of which are not as well lighted as they should be, and it would at the same time provide a favourable opportunity for so arranging the disposition of the lighting as to be much more convenient for the examination and nursing requirements of the patients. (*b*) It would effect a saving on the annual expenditure on lighting. (*c*) It would effect a material reduction of the annual outlay on painting and cleaning works. (*d*) It would be more hygienic and in conformity with modern views as to the method of lighting most suitable for an institution devoted to the treatment of the sick. (*e*) It is more convenient, and attended with a lessened risk from fire. On these points the chief engineer stated that at every other institution where electric light had been recently installed an economy in annual lighting expenditure had resulted, varying from £40 per annum at the Western Hospital, to £625 at the Eastern Hospital. The engineer had communicated with the South London Electric Supply Corporation, Ltd., and had obtained from them an offer to supply electricity to the hospital, which, he stated, was very favourable, viz., 2d. per B.O.T. unit for lighting purposes and 1d. per B.O.T. unit for power, provided that electricity be adopted as an illuminant throughout the entire institution and the supply derived solely from them, and that all gas fittings be removed. Mr. Hatch stated that he felt justified in saying, without hesitation, that the managers would benefit financially as well as in other respects by accepting this offer, and added that the removal of the existing gas fittings did not refer to such fittings as would be required for cooking and for emergency burners in wards, on staircases, &c. The engineer-in-chief's approximate estimate of the cost of the installation of electric light was about £4,000. After very carefully considering the whole question, the Committee were entirely of opinion that electricity should be substituted for gas as the illuminant at the South-Western Hospital. This was agreed to, and the matter referred to the Works Committee.

CONTRACTS OPEN and CLOSED.

OPEN.

Altona.—November 15th. The Building Department of the town requires tenders for a fixed electrical crane of 8,000 kg. capacity. Particulars may be obtained from the Bau-Commission, Rathaus II, Room 112, against payment of 1s.

Australia.—South Australia. January 8th, 1908. One common-battery switchboard and 3,000 subscribers' telephones. Commonwealth Office, 72, Victoria Street, S.W.

Melbourne.—December 17th. Five sections of telephone switchboard for Central Telephone Exchange, Victoria.*

Melbourne.—80 A.C. flame arc lamps for the City Council. See "Official Notices" to-day.

Brisbane.—December 16th. Insulators, iron spindles and copper wire for the P.M.G.*

Port Adelaide.—March 11th. Common battery switchboard, subscribers' telephones and protectors.*

Perth.—November 29th. The time for receiving tenders for 500 dry cells by the Postmaster-General has been extended from September 30th to November 29th.

Perth (W.A.).—December 16th. Postmaster-General's Department. 80 accumulators for telegraph purposes; one voltmeter, 0-300 volts, moving-coil type, circular switchboard pattern, with terminals at back (similar or equal to Stanley-D'Arsonval pattern); two ammeters, 0-10 amperes, moving-coil type, circular switchboard pattern, with terminals at back (similar to Stanley-D'Arsonval pattern); two knife switches, double-pole change-over, to carry 10 amperes (similar or equal to Peel switch).

Sydney, N.S.W.—Meters for the Municipal Council. See "Official Notices" to-day. An extension of the Town Hall sub-station, estimated to cost £16,000, has been agreed to.

Caledonian Railway.—November 4th. The company invites tenders for electric lighting material and fittings. John Fergusson, stores superintendent, St. Rollox, Glasgow.

Dublin.—November 2nd. Electric lighting of Technical Schools in Chatham Row. Specifications, &c. (10s. 6d.), from City Electrical Engineer, Fleet Street, Dublin.

Dublin.—November 4th. Three-phase low-pressure switchboard for the Dublin Corporation destructor depôt. See "Official Notices" October 25th.

Dublin.—November 11th. Stores for the Dublin United Tramways Co. (1896), Ltd. See "Official Notices" October 25th.

Edinburgh.—November 8th. Junctions and pits for tramways extensions for the Corporation.

Gloucester.—November 9th. Stores for the Light Railways Committee. See "Official Notices" October 25th.

G.W. Railway.—November 12th. Stores for one year. See "Official Notices" October 4th.

London.—November 5th. Electric light installation at the Lawn Lane School, Kennington, S.E., for the L.C.C. See "Official Notices" October 25th.

London.—November 11th. Electric fittings, engineers' goods, tramcar fittings, &c., for one year, for the L.C.C. See "Official Notices" to-day.

Mexico.—The Belgian Legation has informed the Direction Générale du Commerce, at des Consulats, 5, Rue de Louvain, of particulars of a concession for works for the reduction of copper ore by electricity. Particulars may be obtained from that source (E. 1,360) through a Belgian agent.

New Zealand.—December 11th. The Napier T.C. requires tenders for electric tramways, lighting and power supply. Frank N. Bower, Town Clerk.

Portrush.—November 2nd. Lighting installation (electricity or gas) for the U.D.C. Specifications at the offices of the Council, Town Hall.

Sophia.—November 9th. The District Finance Commission requires tenders for telegraph material for the Servian State Railways.

Spain.—November 7th. The municipal authorities of Becerril de Campos (province of Palencia) are inviting tenders for the concession for the electric lighting of the town during a period of 25 years. Particulars may be obtained from, and tenders are to be sent to, El Secretario del Ayuntamiento de Becerril de Campos (Palencia).

Madrid.—November 11th. The Provincial Government requires tenders for supply of electricity for five years to (1) Provincial College, College de la Pace, and Maternity Hospital, Est. 124,700 pesetas; (2) Desamparados College and Hospital, Est. 64,000 pesetas; (3) San Juan de Dios and San José Hospitals, Est. 57,450 pesetas.

Stepney.—November 11th. Steam and electric generating plant, &c., for the Council. See "Official Notices" October 11th.

Stretford.—November 4th. Lighting and traction mains for the U.D.C. Messrs. Miller & Wilson, consulting engineers, 19, Brazennose Street, Manchester (specification one guinea).

CLOSED.

Australia.—New South Wales.—The Postmaster-General has accepted tenders as follows:—

W. T. Henley's Telegraph Works Co.—1 mile paper-insulated cable, 208 pairs, 12½-lb. conductors in 220-yd. lengths, at £690 per mile; 3 miles paper-insulated cable, 104 pairs, lead-covered, 12½-lb. conductors in 220-yd. lengths, at £360 per mile; 4 miles paper-insulated cable, 52 pairs, lead-covered, 20-lb. conductors in 220-yd. lengths, at £285 per mile; 5 miles paper-insulated cable, 26 pairs, lead-covered, 20-lb. conductors in 440-yd. lengths, at £180 per mile; 5 miles paper-insulated cable, lead-covered, 20-lb. conductors in 440-yd. lengths, at £115 per mile.

British Insulated & Helsby Cables, Ltd.—2½ miles paper-insulated cable, 39 pairs, lead-covered, 20-lb. conductors in 440-yd. lengths, at £242 per mile.

Union Cable Co.—440 yd. telephone cable, brass sheathed rubber, 208 pairs, at £2,068 per mile.

Perth.—Western Australian Railway Department:—

India-Rubber, Gutta-Percha and Telegraph Works Co.—1 mile $\frac{7}{18}$ vulcanised wire, B.A. label, £24 18s. 6d. per mile; one dozen 10-amp. D.P. cut-outs, 18s. per dozen.

General Electric Co.—500 Robertson lamps, 8 × 220, 10s. 6d. per dozen; six dozen brass adaptors, 7s. 6d. per dozen; 84 lb. 17½ gauge copper wire, 1s. 3d. per lb.

Splatt, Wall & Co.—Vulcanised cable as follows: ½ mile 7/16, £64 per mile; 150 yd. 3/20, £1 18s.; 290 yd. 3/22, £2 5s.

Bexley.—The U.D.C. has accepted the tender of the General Electric Co. for the supply of a traction generator, at £426.

Bradford.—The tender of the Morley Electrical Engineering Co., Ltd., Stanningley, has been accepted by the Corporation for the supply of a 10-H.P. enclosed type motor, for £48 10s., to be used at Bowling Hill, in place of the ordinary tramway motor now in use there.

Burnley.—Last Saturday the Guardians accepted the tender of Messrs. Simpson Bros., of Hapton, for £332, for work to be carried out at the electric lighting station of the local workhouse.

Cape Town.—The tender of Messrs. Koch & Dixie, of Cape Town, has been accepted for the wiring of the new head offices of the Southern Life Insurance Co., in St. George's Street. The estimate for wiring was £380, and for the distribution boards £94, making the accepted tender £474. Mr. E. G. Clifford-Jones, of Cape Town, is the consulting engineer.

Dover.—The T.C. has accepted the tender of Messrs. Babcock & Wilcox, Ltd., for the supply of chain grate stokers to two boilers at the electricity works, at £450.

Erith.—The U.D.C. has accepted the tender of the Ingersoll Rand Co. for the supply of an electrically-driven air compressor at the sewage disposal works, at £606.

Huddersfield.—The Corporation has just placed a contract in the hands of Messrs. Willans & Robinson, Ltd., of Rugby, for two 2,500 K.V.A. turbo-alternators, the plant being required in the early spring of next year, for supplying electric power to certain textile mills in the neighbourhood who have decided to adopt electric motor driving. In view of the importance of giving an uninterrupted supply of energy to these mills, the Corporation decided, after inspecting various turbine stations in this country, to install the above turbines, primarily on this ground.

Ilford.—The Public Health Committee of the U.D.C. has accepted the tender of the Horsfall Destructor Co., Ltd., for the supply of a refuse destructor, at £7,049.

(*Continued on page 735.*)

* Specifications at Commercial Intelligence Office, Board of Trade, 73, Basinghall Street, E.C. Tender forms at Commonwealth Offices, 72, Victoria Street, S.W.

TELEPHONE MANUFACTURING AT LIVERPOOL.

Readers of the Electrical Review who peruse our monthly statement of exports and imports will not have failed to notice the large extent to which we draw upon the foreign manufacturer for our telephonic supplies.

Fig. 1.—The Switchboard Wiring Shop and Stores

Rarely less than £20,000 worth of such material finds its way into this country each month, although, given ordinary trade conditions, there does not appear to be any reason why our home manufacturers should not successfully compete with the Continent and America for this trade.

Helsby Cables, Ltd, who carry out this class of work at their branch works in Liverpool.

To indicate the extent of their connection with British

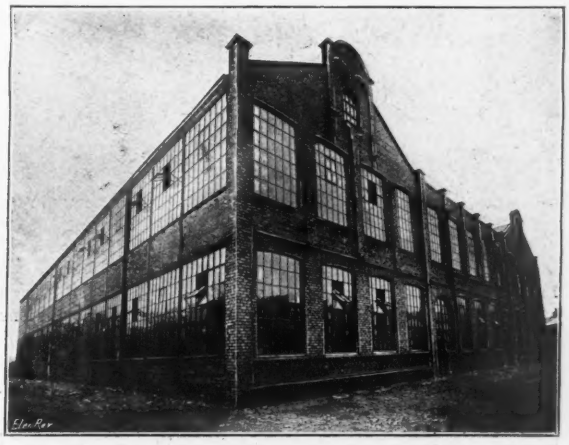


Fig. 2.—The Main Building Devoted to Instrument Work.

telephone work it is only necessary to mention that they have been supplying telephone material to the National

Fig. 3.—View in the Press Department.

That telephone manufacturing in this country is not exactly a lost art can be gauged from the numerous telephone exchanges equipped by the British Insulated and Telephone Co. for the past 20 years, the switch sections of the 5,000-line Birmingham exchange of this company and the London trunk exchange of the British Post Office

(see Electrical Review, February 5th and 12th, 1904) being excellent examples of their work.

The Liverpool works, which are devoted to telephone and telegraph work exclusively, have resulted from the development of a small branch of the old Telegraph Manufacturing Co.'s works at Helsby, where about 100 men were employed in the beginning on telegraph instrument work for the postal and railway authorities.

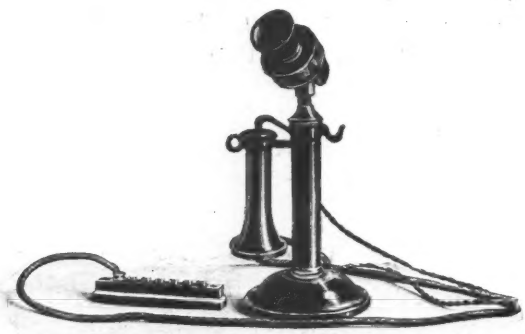


Fig. 4.—Post Office "P.B." Table Set Constructed in the Liverpool Factory of the British Insulated and Helsby Cables, Ltd.

However, within two years of the opening of this branch, orders for telephone apparatus and switchboards were being executed for the National Telephone Co., and, indeed, the continued growth of this business necessitated the acquirement of special workshops for this class of work, which were opened in February, 1891, in Newton Street, Liverpool.

Larger premises were built in 1897 near Renshaw Street, in the same city, to accommodate some 200 men, but owing to increasing business and the difficulty in extending, these were again superseded by the present up-to-date works, which were erected in June, 1903, in Milton Road, Edge Lane, on the outskirts of Liverpool. The site of the new works offers every facility to a rising industry, as it will accommodate buildings six times as large as those put up; moreover, it adjoins the railway, and is very favourably situated in regard to labour.

The buildings at present erected are steel frame structures, of fireproof construction, and designed to give a maximum of light and air to the employés. The main building is a two-storied one, and covers three sides of a rectangle, see fig. 2; a further one-story building, shown in fig. 1, is utilised for switchboard wiring, and as a stores. Each of the four side bays of the main building is 180 ft. long and 40 ft. wide, and is used for the machining and fitting of the innumerable details which are embodied in modern telephonic and telegraphic apparatus. The office section occupies the end of the rectangle. Some 450 men are at present employed in the works themselves, this, of course, excluding the outside gangs engaged in fitting up exchanges, &c.

The Press department, shown in fig. 3, occupying one of the lower bays, plays perhaps the most important part in the factory, and it is astonishing to what degree of accuracy, and with what facility, some of the rather intricate parts of the modern telephone are turned out here. The equipment of English and American tools is of the most modern type, and it is necessarily accompanied by a large stock of special dies, on which great pains have been bestowed, with a view to ensuring perfect work.

At the time of our visit a large amount of press work in connection with the transmitter cases of the new Post Office telephone sets (shown in figs. 4 and 5), for which the company holds orders from the British Post Office, was in evidence.

One of the neatest operations in connection with the primary-battery type of this instrument lies in the making of the insulated base, to which the metal case is pressed so as to enclose the fibre disk, and at the same time exactly fit the transmitter box.

Fig 5.—Post Office Bell Receiver and its Component Parts.

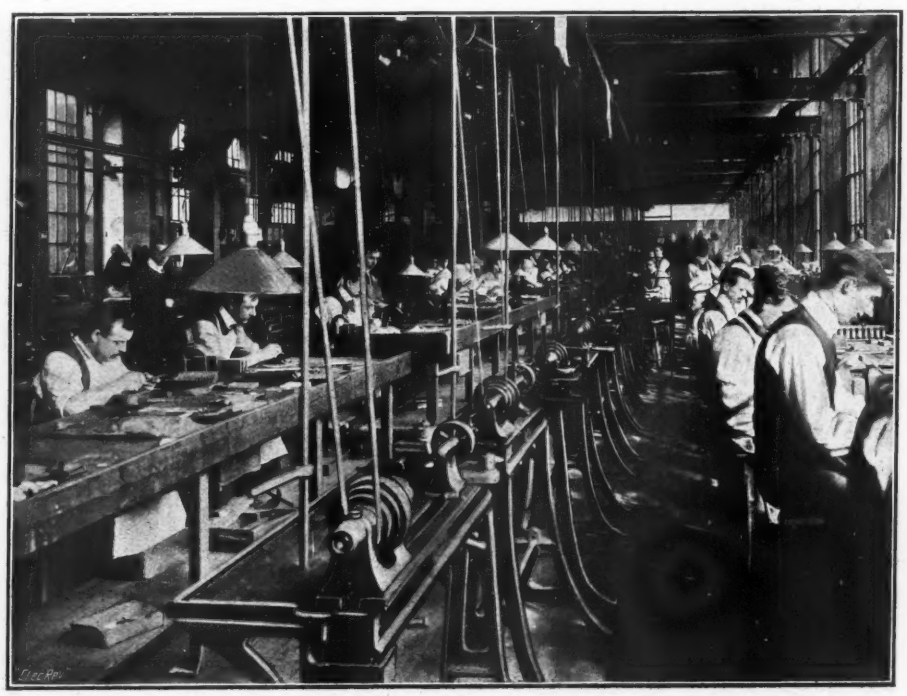


Fig. 6.—The Lower Telephone Fitting Shop.

As showing the large extent to which accurate stamping may facilitate this class of work, it is interesting to record that of the 40 pieces in the above table set, all but two are stamped; and that possibly over a million stampings are required in any fair-sized telephone exchange. Beyond the press shop is situated a general machine shop with an equipment of capstan lathes, milling, drilling and automatic screw machines.

This shop, shown in fig. 8, deals largely with the innumerable details in steel, brass and ebonite, which can be treated as repetition work (including up to 80,000 screws per day), and which go to make up the modern telephone switchboard.

On the second floor is the telegraph fitting shop, fig. 10, with an equipment of small drills and hand lathes. This department is not entirely devoted to telegraph work, but large numbers of Helsby relays, Vyle's polarised sounders, double-current keys, and suchlike work were being dealt with at the time of our visit, in addition to some specialities in the way of magnetos and exploders.

Fig. 7.—Part of the Testing and Inspection Department.

The upper floor of the other arm of the building is largely devoted to a telephone fitting-up shop, and it is provided with an equipment of engraving machines, drills and small lathes. The work, of course, is largely composed of assembling the many relays and other parts turned out by the various departments, the engraving of the many index numbers, letters, &c., for the identification by the telephone operator of the jacks, keys, &c.

The coils employed are all tested for soundness of insulation at 230 volts pressure, although only worked normally at about 20 volts. In addition to the above work, any special telephone power boards required in connection with exchange work are constructed in this shop, and at the time of our visit such a board for the Newport trunk exchange of the Post Office was just completed.

An annexe of this department is equipped as an electro-depositing shop, where the bronzing and plating of the fittings is carried out. Drying and enamelling ovens are also provided. On the lower floor is another telephone fitting shop (fig. 6) with its equipment of instrument lathes (some 200 of which are in use in the works), sensitive drills, &c., and adjacent to it, the coil winding department, where some 3,000 coils per week are turned out, all tested and accurate to within 1 per cent. for telegraph work, and to within 2½ per cent. for telephone requirements. All the coils are hand wound, as as much as 25 per cent. variation may occur in machine-wound coils.

As previously mentioned, the offices are situated at one end of the main building, practically in the centre of the works; above them is the testing and inspecting department, a view of which is shown in fig. 7.

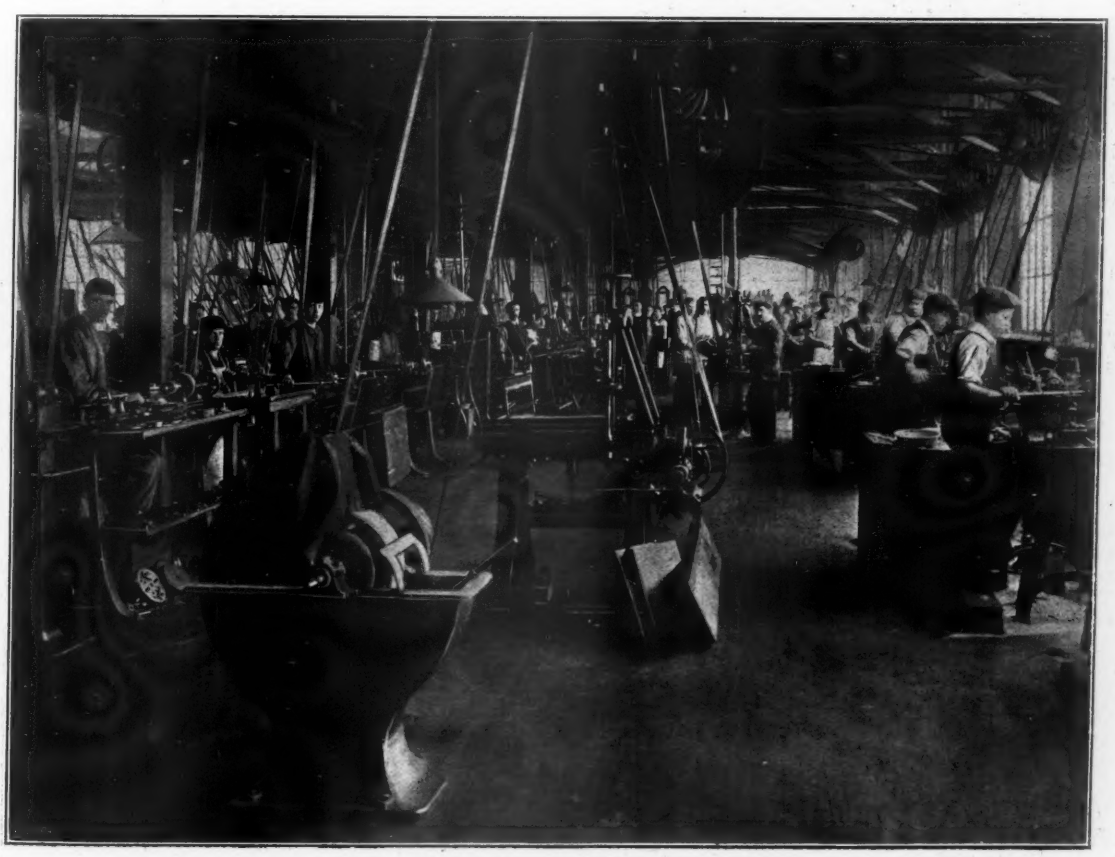


Fig. 8.—The General Machine Shop.

This latter department is, of course, a most important one, as all work, both in progress and complete, is tested here, and passed or rejected, as the case may be.

The main buildings are provided with a system of air heating for cold weather, by means of anthracite stoves, five of which are in use.

Fig. 9.—Cable Forming in the Switchboard Erecting Department.

Electrical driving is employed throughout, some 20 motors, mostly of 10 and 20 H.P. each being employed, utilising the Liverpool Corporation's electricity supply.

Lastly, it remains to mention the switchboard wiring shop and finished stores, which occupy the detached building.

Here the complete Exchange boards are erected, and the intricate wiring connections formed and tested, ready for erection in the Exchange.

We may here add that the boards are nearly all of fireproof construction, the company being pioneers in this direction.

All the woodwork and iron-framing employed in the construction of the boards is supplied from the Helsby works, and all castings used in the other departments are supplied by the Prescot works of the company.

The capacity of the switchboard fitting department is up to 20 300-line switchboard sections per week, complete with their wiring and ready for erection in the exchange.

We have, of course, only been able to roughly indicate to our readers an impression of the works and the operations carried on. That the latter are of a most interesting and effective character can almost be ganged from the excellent work turned out by the company, to whose energetic manager and engineer at Liverpool, Mr. A. Whalley, we are indebted for much of the information here given. It is, perhaps, almost unnecessary to say that Mr. Dane Sinclair, the general manager of the company, gives special attention to this branch of the company's business, which thus receives the benefit of his experience as engineer-in-chief of the National Telephone Company for many years.

Fig. 10.—The Telegraph Fitting Shop.

An Improved Leclanché Cell.—Dr. H. Putz, of Passau, has taken out a German patent for a form of Leclanché battery in which the electrolyte, composed of salammoniac or other normal salt, is mixed with boric acid or any other acid which is not very soluble, and which does not easily attack the zinc and manganese peroxide, or with an acid salt of such an acid. The idea of the improvement is to increase the durability of the contacts and the lifetime of the battery.

The Platinum Market.—According to the annual report prepared by the firm of Gehe & Co., of Dresden, upon the chemical market during the year 1906, which was published recently in the *Chemiker Zeitung*, the consumption of platinum has greatly increased during the last few years. It has been calculated that the United States of America consumes 200 pood; Great Britain, 186 pood; Germany, 132 pood; France, 121 pood; and Russia 8 pood of the metal every year, which equals a consumption of about 647 pood in five of the most important countries that use the metal. It is also reckoned that 35 per cent. of the platinum consumed is old material refined a second time, so that the five countries mentioned require every year about 419 pood of new platinum. The quantity of new metal which is being won at the present time by the undertakings engaged in the business is only about 300 pood per annum, so that there is a considerable deficiency in the quantity available, and this, in former years, has led to an exorbitant rise in the already high price. In fact, within a short time, the price of platinum has risen from about 19,000 to about 28,000 roubles per pood, a similar increase naturally occurring in the prices of the different platinum salts. During the autumn of the year under review, manufacturers of platinum salts were unwilling to quote prices, as they varied from day to day. No great alteration in the price of platinum itself had taken place by the close of 1906, but signs were already apparent that the metal had reached its highest price, and would afterwards begin to fall in value.

CONTRACTS CLOSED.

(*Continued from page 730.*)

London.—L.C.C.—The Highways Committee of the L.C.C. recommends, in connection with the proposed tramways between Hammersmith and Harlesden, an extension of existing contracts with Messrs. Dick, Kerr & Co. for overhead electrical equipment, with the Western Electric Co. for low-tension cables, &c., and with Reid Bros. for the laying of cable ducts. The proposed contract is to contain a provision for the payment of a reduced price for the copper trolley wire in respect of the overhead equipment. The amounts of the contracts are approximately £8,000, £5,500 and £12,500 respectively.

The tender of the Electric Construction Co. has been accepted by the L.C.C. for the supply of rheostat grids for the tramways department, for the sum of £630.

Woolwich.—The B.C. has accepted the following tenders:—

Thos. Rowatt & Co.—100 arc lamp globes, £23.
J. T. Williams & Sons.—To purchase from the Council four loco. type boilers at generating station, £300.
Callender's Cable & Construction Co.—2,000 yd. twin 0·022 armoured service cable, £219.
Siemens Bros. & Co.—Cable, £282.
W. T. Henley's Telegraph Works Co.—Cable, £236.

Manchester.—The Tramways Committee has accepted the tender of Hadfield's Steel Foundry Co., Ltd., Sheffield, for special track-work. The Electricity Committee has contracted with Messrs. J. Spencer, Ltd., for high and low-pressure piping for the new 6,000-kw. turbo-generator at Stuart Street station.

Sheffield.—Messrs. Morrison & Roebuck, of 4, Birley Street, Blackpool, have secured the contract for the electric light installation and electric ventilation at the Royal Hippodrome, Sheffield.

Somerhill, Tonbridge.—In our list of tenders for this contract (page 696 last week) a printers' error occurred in the figures given for Messrs. Leo Sunderland & Co.'s estimate. That firm's tender was £3,438, but in error it was given by us as £3,490, which made it wrongly appear to be higher than those of two other tenderers appearing in our list.

FORTHCOMING EVENTS.

Tuesday, November 5th.—At 8 p.m. At Great George Street, Westminster. Institution of Civil Engineers. Presidential address by Sir W. Matthews.

Thursday, November 7th.—At 8.15 p.m. At 20, Hanover Square. Röntgen Society. Presidential address by Mr. W. Duddell, F.R.S., on "The Production of High-Frequency Operations."

Friday, November 8th.—Meeting of the Northampton Institute Engineering Society. Debate on "The Relative Merits of College and Workshop Training for the Engineer."

At 8 p.m. At the Royal College of Science, Imperial Institute Road, S.W. Physical Society. Discussion on Mr. Campbell's paper on the use of variable mutual inductances; also papers by Mr. L. F. Richardson and Dr. J. Morrow.

Saturday, November 9th.—At 10 a.m. sharp. Institution of Electrical Engineers, Students' Section. Visit to the Bow Works of the North London Railway. Any student wishing to attend should send in his name at once to the hon. sec., Mr. W. Bernard Thompson, "Ewhurst," Hendon, Middlesex.

Wednesday, November 13th.—At 8 p.m. St. Bride's Institute, E.C. Association of Engineers-in-Charge. Presidential address by Mr. W. H. Patchell on "Economic Considerations on the Management of Plant."

Thursday, November 14th.—At 8 p.m. At the Royal College of Science, Dublin. Institution of Electrical Engineers (Dublin Local Section). First meeting of the session.

At 8 p.m. At the Institution of Civil Engineers. First meeting of the session, of Institution of Electrical Engineers. Paper on "The Dielectric Strength of Insulating Materials and the Grading of Cables," by A. Russell.

NOTES.

Supplying Oil to Turbines.—In every engine the 5 or 10 per cent. of frictional loss must be dissipated in the form of heat, and this heat is particularly noticeable in enclosed high-speed engines, for it is mostly communicated to the oil which is forced round all the bearings, and which becomes very liquid as a result of the high temperature attained. For turbines or large installations of turbines there is usually a system of oil circulation by pump, and Mr. Thos. Franklin in *Power* remarks that the central oil supply and cooling plant is better than the system in which each turbine drives its own little pump. He proceeds to describe an English plant wherein oil from the bearings first enters storage tanks in the oil house basement, whence it is pumped through a cooler to the top floor into storage tanks placed there, about 5 per cent. of the total oil passing through filters, whence it would appear that practically the oil circulates 20 times for once it is filtered. The filter consists of a series of divisions in a long tank, the oil passing first through a sieve to remove possible large particles, thence down a pipe from the lower end of which the oil rises up through a stratum of warm water, and upwards through wood wool, and so on through five divisions in all, each with a warm water bottom filling, and wood wool filters above, the filter thickness being diminished successively as the oil pressure is reduced by friction.

Each division holds 6 to 12 in. of water, and in each down pipe for oil is fixed an air-vent pipe rising as high as the original oil pressure.

Some water may be carried forward with the oil, and where bearings are water cooled, there is more or less risk of leakage of one liquid into the other. The author favours the oil pressure being in excess of the water pressure, and would then watch the cooling water for signs of oil. Especially where bearings are of the self-adjusting so-called spherical order, care must be taken that the joints do not leak, and the water connections must be elastic. An ordinary gland will leak; the pipe should have a soft washer tightened up between its end flange and the bearing at the point of entry. A few particulars of oil losses are given, with the object of emphasising the need for a general system of oil drains from all accessories also, and its suitable separation and filtration, all of which seems sound sense when the ease is realised with which many gallons of oil may be wasted in a power station.

Except that organic oils are gradually deteriorated by oxidation, there seems no reason to believe that oil is injured by use—that is to say, it does not become mechanically damaged and less capable of acting as a lubricant. Oil should, therefore, all be saved and cleaned. We are inclined to think that most of the dirt and water would be found to be better got rid of by centrifugal separation than by filtration, and that a final filtration might be accelerated by the same force less violently applied. Oil filtration is purely a mechanical process of separation, and does not call for the same slow movement necessary with water, which is supposed to be attacked by the film on the surface of the filter in a peculiar manner.

No Room in Polite Society!—One of our gas contemporaries last week approved the description of the Manchester Gas Exhibition now running, as "an excellent gem in a rather poor setting." In an article appearing on the next page, arguing in favour of gas and gas engineering being well represented at the Franco-British Exhibition, we find the following open confession:—

"*Electrical engineering ranks in polite society as an occupation fit for the sons of gentlemen. Who cares anything about the gas engineer?*"

Here, too, is indeed a gem in a rather poor setting! We have, of course, had our own ideas on this matter, but to find the *Gas World* voicing them for us—well, how could we expect that! "Gas has been practically boycotted . . . . by most of the usual agencies for circulating information; and also by many of the official organisations for the cultivation of knowledge. When the subject of engineering is mentioned in high scientific circles, the gas variety is ignored. The platform and the Press agree in leaving the gas industry and its followers and services in contemptuous obscurity." How touching are these lamentations. The article is, to our mind, made the more amusing by a reference to a gas director who recently said that the "gas industry in every aspect has been sadly overlooked"—presumably because, as stated later, he personally "had no idea there was so much in it." Why did he not read a weekly gas journal? Perhaps he remembered that in polite society they read something else. Where is there an electrical director who has not a pretty intimate knowledge concerning the extent and potentialities of the electrical industry?

The Speed Regulation of Steam Engines.—This subject, dealt with in the October number of *Cassier's Magazine*, by Mr. S. H. Bunnell, at one time filled a larger space in technical literature than it does to-day. The application of the governor to the steam engine in the days of universal throttling was a simple matter. Between the governor and the throttle valve was link or lever gear, and it was only requisite to pin a rod into a certain hole in a lever in order to ensure that for a given rise or fall of the governor the valve should be closed or opened by the proper amount. If an engine hunted, then it was known that the throttle valve was too much moved by any movement of the governor. If, on the contrary, the engine varied too widely from its rated speed, then there was insufficient movement of the throttle. To ensure that there shall be no hunting, it has been laid down as an axiom by a steam engineer that the reply of a governor to any variation of engine speed shall be less than would be necessary to vary the steam supply sufficiently to bring back the engine to normal speed. Obviously this means that an engine under a heavy load must run below speed, and under light load it must run above speed. A hunting governor tends to effect the reverse action. Governor design aims at producing a governor which, while allowing the lesser speeds for the greater loads, shall minimise the range of speed. The governor is made to stop just short of hunting, and to act well within a narrow range it must be powerful. There was not much power in the old Watt ball governor, but the balls were made heavy. Power must be got by velocity, and to enable a high-speed governor to be used, the balls were made light but were weighted or spring resisted, and the speed was such as to command a considerable degree of energy between two different rates of speed.

All manner of shaft governors have been devised. These, as is well known, consist usually of weights placed on a system of levers within the fly-wheel and acting by centrifugal force resisted by springs. There is a tendency in such a governor if closely designed to hunt, not because of what may be called the position effect of the governor for the proper speed of that position, but because of the inertia effect due to the movement of the weight when changing its

position. This is not a true hunting action, but is one that may be checked by a dash-pot. True hunting may, it is true, be reduced by a dash-pot, but it cannot be eliminated.

In the Rites governor an arm with two heavy end weights lies almost across the centre of revolution of the engine shaft, and, as regards centrifugal effect, is opposed by a spring; but the two weighted ends have a powerful inertia effect and tend to maintain a constant angular velocity when the engine varies its speed, and this is utilised to move the valve eccentric. The arm shifts the eccentric very promptly, and the Rites governor is claimed to be very free from hunting tendencies.

We can hardly accept the author's explanation of the revived popularity of throttling. It was no new discovery that the throttling of steam superheated it. This knowledge is much older than the oldest living exponent of the virtues of superheating by the throttle valve, and no great harm can be done to-day if we say that the virtues of throttling seemed to fade away as the builders of throttle-controlled engines found satisfactory means of expansion governing.

Naturally, with the Corliss types of gear, no force being necessary to vary the cut-off cam, any small governor of small power can be employed, and the fly-ball governor is much employed with a corrective dash-pot.

In a fly-wheel governor the gravity effect must be balanced. Thus, in the Sweet governor, there is gravitational stability at rest or running, and this is a centrifugal shaft governor chiefly useful for large work.

The Rites governor, on the other hand, is not balanced against gravity, and has its field in high-speed work, which it has monopolised. It is very simple, has but one moving part, and will maintain voltage even with a variation of two-thirds or three-fourths of the load in a single second. The gravity effect does not appear to be of moment above 200 or more revolutions, below which speed the governor begins to bump on the stops.

Aluminium Price Reduction. — The price of aluminium is declining, as was predicted in this journal a few months ago as being highly probable, in sympathy with the expansion of the productive capacity in various parts of the world. For the moment the matter apparently mainly affects the continent of Europe, where conflicting reports are in circulation. On the one hand, it is stated that the price was reduced on October 1st from 3s to 2s. per kilogramme or by 33⅓ per cent., whilst on the other, it is declared that large contracts are still being booked at 2s. 9½d. per kilogramme. It appears, however, the real fact is that the principal producers have decided to lower the charge from 3s. to 2s. as from January 1st, 1908. No doubt the impending diminution, apart from the expanding output of aluminium, is prompted by the fall in the price of copper, as the former metal is becoming increasingly employed as a conductor as a substitute for copper in electrical work. As far as production is concerned, it is tolerably well known that all the existing aluminium producing works have been, or are being, enlarged, and that new works are in progress or practically completed, so that either in this, or next year, the tonnage of the metal placed upon the market will be materially augmented. In the United States the Aluminium Co. of America has not only assured itself of further deposits of bauxite, but has also largely extended its works at the Niagara Falls and at the Shawinigan Falls in Canada, and in this way the company will be able to double its output of the metal. The British Aluminium Co. has acquired 20,000 H.P. at Loch Leven, and also water-power at Stangfiord, in Norway, and at Orsières, in Switzerland, and two other companies have been constituted in England. The Aluminium Industry Co., of Neuhausen, in addition to its works at that town, and at Lend in Austria, has two works in progress in the Vallais canton, which represent 18,000 H.P. and 20,000 H.P. respectively, and which are nearly ready to begin operations. In France, the Froges and Péchiney companies are engaged in extending two large water-power plants, and they will thus be enabled to increase their out-turn by 4,000 tons per annum. In addition to this, the Société d'Electrochemie intends to start 4,000 H.P., and the Société des Forces Motrices de l'Arve also depends upon the utilisation of 12,000 H.P. for the production of aluminium. Besides these, other companies in France are reported to be in progress, whilst Italian works near Popoli and Bussi are asserted to be nearly at the stage of completion. If due consideration is given to all these new works and extensions it is calculated that the output of aluminium, which amounted to 14,500 tons in 1906—other estimates place the production at 18,300 tons—will be doubled next year and further increased in succeeding years. The calculation naturally represents what may be termed "a large order," but, at any rate, the out-turn will inevitably be materially augmented, and in the circumstances it is easy to understand the determination to lower prices next January in order to provide an outlet for the expanding production, especially for electrical purposes. The reduction from 3s. to 2s., it may be mentioned in conclusion, is not the lowest price which has been suggested, as the question of fixing 1s. 7d. per kilogramme has already been under consideration in France.

Electrochemical Notes.—An Electrical Process for the Removal of Hammer-Scale.—A paper was read at the last meeting of the American Electro-Chemical Society held in Philadelphia by Mr. C. J. Reed, of that city, in which the author described a process he had devised for freeing from hammer-scale by cathodic reduction. The objects to be treated are made cathodes in a bath of dilute sulphuric acid having a specific gravity of 1·20, and containing 27 per cent. of strong acid. They are then submitted to electrolytic action, a current having a cathodic density of ¼ to ½ ampere per sq. in. being employed at a temperature of 60° C. The result of this treatment is stated by the inventor to be not that the oxide of the scale is reduced to the metallic condition, but that it is reduced to a lower state of oxidation. It then dissolves, and is converted into ferrous sulphide, no portion of the original iron article being attacked. Mr. Reed claimed that his new process was cheap, an economy of from 50 to 75 cents per ton being attainable in manufacturing conditions compared with the expense of other methods of removing the scale. It occupied only a short time, as the thick hammer-scale on rolled bars could be removed in two or three minutes; and it was applicable to sheet, rod, or wire metal. Mr. Reed has also obtained protection for his process (U.S. Patent, No. 855,667, June 4th, 1907). In the patent specification he seems to describe a somewhat modified process, in which ferrous sulphate is simultaneously obtained as a by-product. He mentions that the anodes consist of lead, round which sulphur itself, pyrites, marcasite, or pyrrhotite (magnetic pyrites) is placed to act as a supply of sulphur. The electrolytic vessel he employs is fitted with a diaphragm. The layer of ferric or ferrous ferric oxide which composes the hammer-scale dissolves, is reduced at the cathode, and yields ferrous sulphate. The electrolyte is used until it is nearly saturated with sulphate, when it is removed, and allowed to cool and crystallise.

Electrical Reduction of Oxides and Sulphides.—Mr. F. M. Becket, of Niagara Falls, U.S.A., has taken out an American patent for an electrical smelting process of reducing the oxides of such metals as chromium, tungsten, molybdenum and vanadium, which is stated to yield the simple metals or alloys thereof very free from carbon or silicon. The process depends on the use of so large an excess of silicon, that the whole of the oxygen is converted into silica. The reduction takes place in an electric furnace, preferably provided with a basic lining. Alloys of the metals mentioned with iron or nickel can also be obtained in the same fashion. In another patent, Mr. Becket proposes to reduce the sulphides of molybdenum and vanadium by identical treatment, the sulphide being preferably kept in excess. The by-product is a bisulphide of silicon.

The Ageing and Sterilising of Liquids.—Herr V. Dorn, of Wilmersdorf, near Berlin, has taken out an American patent for a process of improving wines and spirits, or of sterilising liquids, which depends upon the use of frictional electricity. The experiments carried out by Herr Dorn have convinced him that, whereas dynamic electricity produces no effect or acts prejudicially upon such liquids as are in an unstable condition, or have undergone some chemical process of decomposition, *e.g.*, alcoholic, lactic acid or acetic acid fermentation, static electricity, on the other hand, produces changes in such liquids within a short period of time which resemble the effects ordinarily produced by long-continued storage. He also finds that it is necessary, if the influence of the electrical discharge is to be beneficial, that the liquid under treatment should be simultaneously exposed to the action of oxygen. He has, therefore, designed an apparatus for the artificial ageing of spirits. The apparatus consists of an electrical induction machine of any known kind, driven by means of a motor, and placed in connection with two Leyden jars. The liquid to be treated is placed in a cask, through the bunghole of which the two electrodes communicating with the electrical machine are passed. The electrodes themselves are enclosed in glass tubes and terminate in platinum points, which are bent away from each other within the cask in order that the electricity may have to pass through a considerable amount of the liquid. Between the two leads a glass tube traverses the cork connected with a cylinder and a purifying vessel for the supply of a current of pure oxygen. The entry of oxygen into the liquid keeps it in constant motion, and as soon as the electrical circuit is closed the oxygen is rendered active by being partly ozonised and partly ionised. The treatment is claimed to age a spirit satisfactorily. A similar employment of static electricity is permissible for the destruction of objectionable micro-organisms in liquids.

Electro-Plating of Small Objects.—The "Gesellschaft für Metallindustrie," of Fröndenberg, has recently patented in Germany an apparatus for the electro-plating of small objects, such as pieces of wire and the like, of which the following description may be given:—The vessel is a wooden trough containing an electrolyte of suitable composition. Above it is arranged a system of six horizontal rollers round which an endless cloth travels in such a direction as to form two V-shaped pockets below the level of the liquid. In these pockets the objects which are to receive a deposit are placed, and in consequence of the revolution of the cloth they are constantly tumbled about within the bath. The spindles of the two submerged rollers round which the cloth runs to form the pockets are made the cathodes of the apparatus; while the anodes are a pair of metal plates depending from the upper edges of the vessel, and curved inwardly so as to surround the pockets on the outside and underneath.

The Nationalisation of Hydro-Electrical Installations in Italy.—The Italian journal, *Il Sole*, for September 7th last contains an interesting letter from Engineer Azari—well known in connection with his studies in hydraulic and electrical work—to the President of the Council of Ministers at Rome, in regard to the nationalisation of the hydro-electrical installations without the expenditure of capital on the part of the State, pointing out some of the advantages to the nation in so doing.

Engineer Azari starts his communication by a statement of facts as to the exceptional facilities which exist in Italy for utilising water-power for the development of industrial undertakings; many of the northern localities appear to be purposely favoured by nature with a substitute for coal—of which product Italy is particularly barren—and such considerations being coupled with the

efficiency and intelligence of the workmen, the best possible conditions exist for progress in industrial undertakings. At the present time the State can, by suitable legislative provisions, assist and promote a healthy development of these undertakings, whilst securing to itself terms upon which within half a century it will become the proprietor of all the hydro-electrical installations.

Under the existing conditions of the fiscal laws, concessions are granted by Provincial and Common Councils, whereby hydro-electrical works are established on private initiative without sufficient regard to linking up and organising the separate undertakings, and thus—notwithstanding the best intentions of the capitalists and scientific men who occupy themselves with these matters—the most favourable results cannot be attained.

Already hydro-electrical works have been established approximating 250,000 H.P., and it is comparatively safe to assert that within another 10 years this figure will be doubled; to say to what dimensions it may grow during the next half-century is quite impossible.

The practical way to arrive at the desired results appears to be by granting State concessions on the most favourable terms whereby immediate development may not be hindered by taxation prior to the time when a revenue is being earned; the writer would adopt a sliding scale for any State charges whereby during, say, the first 30 years very low taxes would be levied and some increase made perhaps during the following 30 years, but his whole point is to secure to the State the ultimate ownership of the undertakings at the end of 50 or 60 years, and therefore, in fairness to the shareholders, every opportunity must be given them to obtain the return of their capital with fair interest during the period of the concession, whilst the State can afford to wait for the continuous benefits that will ultimately be derived.

Not only this, but his scheme will offer work to many of his countrymen who at present go abroad to seek employment and create by their handicrafts the opportunity for employment of capital abroad instead of at home.

These considerations lead him to assert that, if the law is modified to serve the best interests of the nation, a solid foundation will be laid that will assure to Italy a rapid transformation of her industrial conditions and the first place amongst the manufacturing countries of Europe on the most advantageous and economical basis.

Copper.—Although at the time of writing there is a distinct rally in the price of this metal, it would be dangerous to predict a continuation of the rise. It is more probable that the patient consumer, tired of waiting, has come forward with a few orders, and the extremely sensitive market has responded at once. If the needs of the consumer or consumers are urgent we shall of necessity see a further enhancement of prices. Commenting on the recent depressed condition of the market, the *Mining Journal* gives, as the condition which brought about the heavy liquidation, the American trade and financial position. Considering the important part played by the States as producers, and the extensive organisation controlling that production, this must necessarily be so in any decided movement. As the same journal expresses it: "The financial magnates of the United States control a majority of the world's production, and within limits, can make the market what they will," deducing from these and other premises that the movements of the market are consequently beyond the limits of calculation. One can only hope that ultimately a steadiness will be introduced into the market by the rise in importance of the Australian output.

From the *Financial Times* we gather that the same influences which operated to reduce copper prices were responsible for the recent "slump" on the New York Exchange. Large holders of copper securities, Messrs. Heinze & Co., being compelled to suspend, involved the Mercantile Bank, and, while declaring their intention to meet all liabilities, effectually frightened the market.

Under existing circumstances it is becoming very difficult for the trade consumer to satisfy the needs of his business. He cannot, of course, buy on freak prices, and if he buys on a fall the market revives before it has reached its lowest. If, again, he patiently waits till the price has fallen to a phenomenal level, and then tentatively places a few orders, the active speculator, ever on the watch, so inflates them with his own buying that the price goes up at once above anything like bargain rates. The natural sequence to all this is for the consumer to become his own mineowner. A ring of producers at war with a ring of manufacturers is bad economics and bad commerce.

Co-operative Buying.—In the *Ironmonger*, "Bypasser" has some observations to offer on this subject, which should possess a certain amount of interest for electrical men as well at the present time:—"The question of co-operative buying is one of those problems arising out of federated activity which appear to defy all satisfactory solution. The principle of co-operative purchasing is clearly in harmony with the principle of trade federation, yet on the other hand, it appears to be quite opposed to that system of free selection which all traders hold should be exercised by the general public. Tradesmen do not appreciate the public being tied to one particular store, and, following the same line of thought, it is clear that manufacturers generally will not appreciate associations of ironmongers giving preference to particular makers of hardware, as by such action other goods of the same class are practically shut out. And when they are shut out, danger commences, for the maker must find a market, and if he cannot find it where he would, he may find it in some place which, from the ironmonger's point of view, is not desirable. It may be perfectly lawful to buy co-operatively, and it is certainly profitable, but whether, in view of the importance of maintaining good relationships with the wholesale trade and the manufacturers, such line of action is expedient, is another matter. Looked at in another way, it might be argued that collective buying is the thin end of the "combine" wedge, for if all the ironmongers in a given town bought and sold collectively, we should stand at the threshold of a fusion of businesses which would destroy the individuality of each, and create one mammoth establishment, to the great benefit, possibly, of some traders, in the saving of expenses, but of doubtful advantage from the public point of view."

High-Tension Troubles in a Humid Climate.—The Frontino and Bolivia Gold Mining Co., Ltd., of 184, Gresham House, have written to their shareholders as follows:—

"Electric Power Plant, *October 18th*, 1907.—In view of inquiries received from shareholders as to the working of the power plant, the directors think it will be of general interest to state that the plant is reported by recent advices to be working well, though at a reduced voltage. Difficulty was experienced at the start, owing to the humidity of the atmosphere at the power station, in running the generator at the voltage (5,000) for which it was designed, and it is at present being run at 2,700 volts. Sufficient power for present purposes is obtained from the plant working at this reduced voltage, and the board are advised that if experience should prove it to be desirable to run the generator permanently at the reduced voltage, the additional power can be obtained without much expense by the use of step-up transformers."

Electricity Supply Showroom at Stepney.—The Stepney E.C. is about to open a showroom at its electricity works in Whitechapel, and a notice of interest to manufacturers appears in our advertisement pages to-day.

Electric Shock Fatality.—An inquest was held at Dunedin in September, concerning the death of George Shrimpton, who was killed at Waipori electrical works. The evidence was practically to the effect that deceased had, while he was supposed to be otherwise occupied, started, with another employé named Clothier, to carry pipes into the switchroom. According to a New Zealand paper, deceased had not been instructed to go into the place at all; on the contrary, he had been warned against doing so. He placed a pipe carried by himself on the floor of the room, and on turning to Clothier to assist him to lower his pipe, his (Shrimpton's) head came in contact with one of the switches, the shock killing him instantly. The jury returned a verdict that deceased was accidentally killed through coming into contact with a live wire, but that no blame was attachable to anyone. They recommended that the doors of the main building in future be kept locked and the keys kept in the possession of someone in authority.

Late Legal Intelligence.—FRYER *v.* THE HAMMERSMITH BOARD OF GUARDIANS.—In the King's Bench Division on Wednesday, before Mr. Justice Lawrence and a special jury, Mr. Walter John Fryer, a mechanical and electrical engineer, trading as J. W. Fryer & Co., at Harrow Road, sought to recover from the Hammersmith Board of Guardians the sum of £606 18s. 4d. for work done and materials provided in pursuance of a contract dated July 15th, 1905. The defendants said the amount claimed was in excess of that to which the plaintiff was entitled under the contract.

Mr. Eldon Bankes, K.C., and Mr. Lewis Thomas appeared for the plaintiff, and Mr. Ellis Hill represented the defendants.

Mr. Bankes, in opening the case, explained that under the contract the plaintiff agreed to install the electric lighting at the new workhouse and infirmary erected by the defendant Board of Guardians. In the contract was a provisional sum of £400 for extras and special fittings, but at that time no one knew what the cost of the extras and special fittings would be, as they were to be selected by the Guardians. A number of samples and drawings were submitted for the inspection of the Building Committee of the Guardians, and these samples were put up in order to show how they would look. These consisted of outside standards and electroliers for the inside of the building. On each sample the price was marked. At a meeting of the Committee on September 19th, certain fittings were selected and the work of erecting was at once proceeded with. It was found that the total cost came to £682. On May 7th a certificate for £700 was given to cover the cost of the extras, but there was a disputed item, and the plaintiff agreed that he would take £606 upon the £700 certificate. But this amount was not paid, as an inquiry was instituted by some indignant ratepayers, who criticised the Guardians for their extravagance in connection with the building, and it appeared that the Guardians, in order to save their skins in the estimation of the public, wished to save as much as they could. He was sure, however, that the jury would not allow them to do so at the expense of a tradesman who had done his work well. The original contract was for £5,600, and with extras that was brought up to £6,570, of which sum the Guardians had paid £5,900. The matter was brought by the ratepayers' agitation to the attention of the Local Government Board, and they refused the Guardians power to borrow additional money until they had settled this dispute with Mr. Fryer.

Mr. Fryer, the plaintiff, gave evidence in support of his case. He said the fittings were selected by the Building Committee of the Guardians from the priced samples.

In cross-examination, Witness denied that he gave an undertaking that the provisional sum of £400 should not be exceeded. The fittings were put in upon the instructions of the engineer to the Guardians.

In reply to his Lordship, Mr. Bankes said the work had been

done and approved, but the Local Government Board refused to sanction any further borrowing to pay for it.

Mr. Hill said, though the engineer gave a certificate, it was on a conditional understanding.

Witness said that in all there were about 4,000 lights in the building.

Mr. Walter Toy, plaintiff's assistant, said he was at the meeting referred to, and no one spoke about the provisional price.

Mr. Ellis Hill, addressing the jury on behalf of the Guardians, said the sanction of the Local Government Board had been obtained for the contract, but the price in the contract was only £5,641 altogether. Mr. Neighbour, who had been vice-chairman of the Building Committee, would give evidence that Mr. Fryer represented that the samples which were shown would come within the provisional amount of £400.

Mr. Wm. Neighbour, giving evidence, said that if he had known the price of the fittings in question had been above £400 he would not have approved of them.

Mr. Enright, a member of the engineering firm retained by the Guardians, also gave evidence.

Mr. Hill submitted that in the circumstances the defendants ought not to be called upon to pay the amount claimed.

The jury intimated that they did not desire to hear Mr. Bankes reply.

The jury then found that Mr. Fryer did not represent that the extras would not exceed £400, and they also found that he signed the contract on the faith of a letter that the sanction of the Local Government Board had been obtained. A verdict was returned for the plaintiff for the amount claimed.

Judgment was given accordingly with costs.

Electro-Harmonic Concert.—The next concert (ladies' night) of the Electro-Harmonic Society is to be held at the Holborn Restaurant (King's Hall) on Friday next, November 8th, at 8 o'clock p.m. The programme will include songs by Miss Annie Bartle and Mr. Harold Wilde, and there will be a number of selections by the orchestra, amongst them (by desire) Schubert's "Unfinished Symphony." The other items will include humorous sketches by Miss Fanny Wentworth, and imitations of child life by Mr. H. M. Helmsley, while Mr. Percival Mackenzie, the art humorist, will also entertain.

Franco-British Exhibition, 1908.—The Manufacturers' Section of the London Chamber of Commerce at its last meeting passed a resolution expressing the opinion that British manufacturers and traders should favourably consider the desirability of supporting this Exhibition, in view of the probable attendance of large numbers of visitors from all parts of the world, and the opportunity thereby afforded of making their specialities more widely known.

Mr. Charles Charleton (chairman of the Council and a member of the Executive Committee of the Exhibition) explained in detail the organisation of the Exhibition, which he pointed out was not competitive, and was intended to afford an opportunity of displaying the best productions of both countries. He also referred to the substantial nature of the guarantee fund, by which the financial stability of the enterprise was assured, and to the large measure of support already given by manufacturers and traders who had decided to participate in the Exhibition.

Institution and Lecture Notes.—American Institute of Electrical Engineers.—On October 11th, in New York, the new president, Mr. Henry G. Stott, delivered his inaugural address. From a summary printed in the *Western Electrician* we learn that the Institute has now over 5,100 members, of whom 10 per cent. are resident in foreign countries. Besides the New York headquarters the Institute has 20 sections and 17 university branches located at all great centres of membership. At these sections and branches not only are the papers presented at the New York meetings discussed, but original papers are also presented and discussed. They were thus gradually evolving an organisation somewhat similar to that of the State and Federal Governments, and as the process of evolution went on, the constitution might again have to be readjusted to meet the new conditions. Article I of their Constitution referred to the "advancement of the theory and practice of electrical engineering and of the allied arts and sciences."

"When we look back over our *Transactions* for the last 10 years, we cannot help being struck by the admirable way in which we find there recorded almost everything of note which has contributed to 'the advancement of the theory and practice of electrical engineering,' but so rapid has been the evolution of the theory and practice of electrical engineering, that the 'allied arts and sciences' have been to a large extent squeezed out. With every new application of electricity comes the demand for men who are not only specialists in that particular art, but who at the same time are electrical engineers, as, for example, in the applications of electricity to electro-chemical processes, railways, illumination, transmission of power, mining, utilisation of electricity in the numberless manufacturing processes, all of them calling for highly specialised knowledge in the allied arts. It would, therefore, seem as if the time is now ripe for carrying out all the objects mentioned in our Constitution, and the Papers Committee is now endeavouring to broaden the scope of the Institute work without allowing their efforts to scatter too much. In order to assist in this work some of the committee work has been reorganised. For example, the old High-tension Transmission Committee, which has done such excellent work, now becomes a sub-committee of the Papers Committee, and a new sub-committee on railways has been formed. Additional sub-committees will be appointed as necessity seems to require."

The board of directors has authorised the appointment of a committee on education to co-operate with other education committees in recommending a syllabus of studies for electrical engineers at American universities. In furtherance of this work a special meeting devoted to educational subjects will be held toward the end of this year.

Institution of Electrical Engineers (Leeds Section).—On Thursday last week, Mr. G. D. Aspinall Parr read his inaugural address as chairman of the Section. Referring to the training of engineers, he remarked on the difficulty experienced by students in obtaining admission to works for one year after leaving school, at the age of 17, preparatory to entering a technical college, as recommended by the Committee which reported on the subject last year. Mr. Parr appealed to manufacturers and central station engineers to afford special facilities to young men for entering their works in this way, as well as after the completion of their college training, in the interests of the electrical engineering profession as a whole, co-operating with the heads of departments of the colleges, who would gladly furnish particulars as to the merits and qualifications of their students.

Nottingham Guild of Mechanical and Electrical Engineers.—This body held its tenth annual meeting at the Welbeck Hotel, Nottingham, on Tuesday, October 8th. Alderman C. Bennett, J.P., was again elected president, and among the vice-presidents are Mr. J. Aldworth, city tramway engineer, and Mr. H. Talbot, city electrical engineer. The secretary, Mr. F. A. W. Taylor, in his report, said that the Guild had made very satisfactory progress, and its financial position was particularly sound. At the meeting held on October 22nd, a paper on the "Manufacture of Pig-iron" was read by Mr. J. Crawford.

University of London.—At the annual general meeting of the Old Students' Association at University College, Dr. Tempest Anderson was elected President of the Association for the year 1907-8. Mr. George A. Aitken was elected treasurer, and Mr. E. Denison Byles, B.Sc., secretary. The annual dinner of the Association will be held on Thursday, December 5th. Dr. Tempest Anderson will preside. The new wing that has recently been added to the college will be completed by that time, and will be open for inspection. Former students of the college who desire to be present should communicate with Mr. George A. Aitken, at 42, Edwardes Square, Kensington, W.

Armstrong College, Newcastle-upon-Tyne.—A series of electrical lectures is being delivered at the present time at this College. The lecturer is Mr. F. O. Hunt, A.M.I.E.E., and the lectures have been arranged with the Council of the College mainly for the benefit of insurance men—members of the Insurance Institute of Newcastle-upon-Tyne—for the closer study of electricity from the Fire Insurance standpoint. We understand that the lectures are being followed with the greatest possible interest.

Finsbury Lectures.—On Wednesday, November 13th, Prof. S. P. Thompson, F.R.S., will commence a course of six special lectures on "The Permanent Magnet," at the City and Guilds Technical College, Finsbury. Some particulars appear in our advertisement pages.

The British Correspondence School of Electrical Engineering.—We have received a syllabus of the courses of correspondence education under the above title, of which Mr. Frank Broadbent and Mr. Andrew Stewart are the technical directors. They are starting on a modest scale, and do not profess to teach everything, but are for the time being specialising in courses which, they think, will be of the greatest service to the rank and file of the electrical industry. It is thought that there is a large body of men who, on account of the nature of their employment, cannot attend evening classes in technical schools, nor can they afford an expensive course of electrical engineering training, but who would be benefited by such a practical course of instruction as it is proposed to give them. The directors will specialise in practical electrical engineering, and specially call attention to their courses in wiring work and the management of installations, and their elementary electrical engineering course, which is suitable for apprentices. There would seem to be scope for courses of this kind, without clashing with the existing correspondence institutions.

Electrical Engineers (R.E.) Volunteers.—The establishment strength of the Electrical Engineers (R.E.) Volunteers has been cut down, and as resignations came in the vacancies were not filled up. Last year the strength was 750; now it is 500. Resignations have been very few in London, but some men who live in the country have sent in their papers. The winter training will be carried on as in previous years.—*Pall Mall Gazette.*

Carbide of Calcium in Europe.—According to a statement issued by the Consortium für Elektrochemische Industrie, of Nuremberg, the consumption of carbide of calcium in Germany has considerably increased in recent years, and amounted to 30,000 tons in 1906. The demand was only met in part by German works, the remainder of the supplies being obtained from works in Switzerland, Austria and the Scandinavian countries. Most of the German producers have endeavoured to increase their output, but as they nearly all use water power, it has only been possible for a few of them materially to augment the production by extending the existing plant. A number of the firms have had to seek fresh sources of water power, but from the time of obtaining a concession to the starting of a new works is a long way, which, as a rule, requires a period of from two to three years. The capacity of the works coming into consideration for the German market has increased this year by about 20,000 tons, and new works have also

arisen, having an output of 25,000 tons. In the course of next year new factories will be brought into operation in Switzerland, Norway, Germany, Italy, Austria and France, and these will have a total of 60,000 H.P., whilst further extensions are in prospect for 1909. By that time it will be possible to depend upon such large quantities for international markets that instead of a scarcity, there should be a superabundance of carbide of calcium. The trade is exposed to considerable fluctuations, and, as an instance, it is mentioned that the Prussian State railways, which are the largest consumers in Germany, with an annual requirement of from 8,000 tons to 9,000 tons, will withdraw from the market in the course of the next few years.

Appointment Vacant.—Lecturer in Electrical Engineering Department of the Glasgow and West of Scotland Technical College (£150 to £200).

Electrical Engineers of the American Iron and Steel Industry Organise.—The *Western Electrician* says that the first annual meeting of the Association of Iron and Steel Electrical Engineers was held in Pittsburg on October 11th and 12th. The Association, which is the outgrowth of a meeting of electrical engineers in Pittsburg last spring, has for its object the application of electrical machinery and appliances to the iron and steel industry. Thirty-three men prominently connected with electrical generating plants and equipment departments of a number of large companies throughout the country constitute the charter membership. The first session of the annual meeting was devoted largely to the election of officers, with the following result:—President, James Farrington, superintendent of electrical department of La Belle Iron Works, Steubenville, Ohio; first vice-president, J. C. Reed, electrical engineer of the Pennsylvania Steel Co., Steelton, Pa.; second vice-president, G. W. Sturgess, electrical superintendent of the Lackawanna Steel Co., Buffalo, N.Y.; secretary, G. H. Winslow, electrical engineer of the National Tube Co., Pittsburg; treasurer, E. W. Yearsley, electrical engineer of the Midvale Steel Co., Philadelphia. The initial meeting was very successful, and it is planned to hold a number of meetings each year to take up electrical questions.

Electricity Works in France.—At the beginning of this year, says the *Electricien*, there were in France 1,413 electricity works, and only 824 gas works. Of the former, 942 were D.C., 438 A.C. and the remainder both D.C. and A.C.; 157 supplied one-phase only, 20 two-phase, 256 three-phase, and five one-phase and three-phase. No fewer than 831 works relied wholly upon water-power, while 169 used water-power supplemented by steam, gas or oil engines; of the remaining 413, 306 used steam, 43 poor gas, 28 gas, 10 petrol and seven electricity (presumably bulk supply sub-stations), the rest having mixed systems. Unfortunately, there are no data as to the sizes of the various installations, many of which must be very small ones.

P. & O. Batti-Wallah's Concert.—This interesting Society of P. & O. electricians held its first concert for the current season at the Holborn Restaurant on Friday evening last.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—MR. EDWARD SHAW, on resigning the position of assistant mains engineer with the Yorkshire Electric Power Co., has been presented by the members of the staff with a dressing case and silver cigarette case.

We understand that MR. A. A. DAY, A.M.I.C.E., M.I.E.E., the borough electrical engineer and general manager of the Bolton electricity works and tramways, has been called in by the Wigan Corporation to go over their tramway system and electricity department, and report thereon.

MR. T. JENKINS, of H.M. Dockyard, Portsmouth, has been appointed shift engineer at the Bridlington Electricity Works.

The Partick Electricity Works Football Club held a successful smoking concert on Friday, October 25th. Mr. R. C. Cressey presided, and during the interval, on behalf of the staff assistants and workmen in the department, he presented Messrs. Bennet, Black, and McDonald, who have recently resigned their positions on the clerical staff, with a set of books (nine volumes), lettercase, and "Swan" fountain pen, respectively.

General.—MR. LEONARD W. HOLMES, the London partner of Messrs. J. H. Holmes & Co., electrical engineers, of Newcastle-on-Tyne, has now returned to business after his severe illness, which we mentioned in this paper last March. Mr. Holmes desires to thank his many friends for their kind inquiries regarding his progress during his illness and convalescence.

MR. E. S. WOOLLARD MOORE, Assoc.M.Inst.C.E., who was associated with the Electric Construction Co., Ltd., for many years as chief engineer and as joint manager, has taken offices at Central House, New Street, Birmingham, where he is carrying on business as consulting engineer.

MR. T. A. NUNWICK, who has for many years represented Messrs. Dorman & Smith, of Ordsal Electrical Works, Manchester, has now, in addition to this work, taken up an agency for Messrs. C. J. Thursfield & Co., electrical fittings manufacturers, of Cecil Works, Birmingham, and has opened showrooms at Onward Buildings, 207, Deansgate, Manchester, for the convenience of Messrs. Thursfield's customers in the north.

NEW COMPANIES REGISTERED.

Stearn Electric Lamp Co., Ltd. (95,340).—This company was registered on October 21st, with a capital of £4,070 in £10 shares, to carry on the business of electrical engineers and contractors, manufacturers of and dealers in electric lamps and railway, tramway, electric, magnetic, galvanic and other apparatus, &c., and to adopt an agreement for the acquisition of the business carried on at Kew Gardens, Surrey, by the Zurich Incandescence Lamp Co. (incorporated under the Swiss Limited Liability Laws). The first subscribers (each with one share) are:—Mrs. E. F. Stuart, 18, Belsize Crescent, N.W.; C. H. Stearn, 25, Kew Gardens Road, Kew, electrician; C. Baly, 140, Harley Street, W., dental surgeon; Major A. C. Woodley, V.D., 235, Burrage Road, Plumstead; D. Carter, Bank House, Grantham, gentleman; C. E. Escher, 18, Seinaustrasse, Zurich, electrician; and C. E. G. Stuart, 11, Belsize Crescent, N.W., electrician. No initial public issue. The number of directors is not to be less than two or more than seven; the first are C. Baly, A. C. Woodley, C. H. Stearn (managing director), C. E. Escher, and C. E. G. Stuart; qualification, four shares; remuneration as fixed by the company. Registered office, 47, Victoria Street, Westminster.

Bergtheil & Young, Ltd. (95,405).—This company was registered on October 26th, with a capital of £12,000 in £1 shares, to acquire the assets and liabilities of Bergtheil & Young, Ltd. (incorporated in 1904), to adopt an agreement with the said old company, which is about to wind up voluntarily, and to carry on the business of importers, exporters and manufacturers of and dealers in all kinds of electric, magnetic, galvanic, chemical and other machinery, apparatus and appliances and electrical or other engineers' requisites, &c. The first subscribers (each with one share) are:—A. Bergtheil, 12, Camomile Street, E.C., electrical engineer; E. Bergtheil, 12, Camomile Street, E.C., electrical engineer; S. Smith, 12, Camomile Street, E.C., secretary; A. G. Elliott, 12, Camomile Street, E.C., engineer; C. E. W. Ogilvie, 18, Essex Street, Strand, W.C., solicitor; A. J. Turnnidge, 18, Essex Street, Strand, W.C., shorthand writer; and M. Mohr, 26, Lymington Road, N.W., secretary. No initial public issue. The first directors are A. Bergtheil, E. Bergtheil and A. G. Elliott; qualification, £1,000; remuneration as fixed by the company. Registered office, 12, Camomile Street, E.C.

Simplex Gas Engine Starter, Ltd. (95,323).—This company was registered on October 19th, with a capital of £5,000 in £1 shares, to acquire, deal with and turn to account patents for starting gas engines, and to carry on the business of manufacturers of, and dealers in, starters for gas and other engines, electricians, engineers, suppliers of electricity, &c. The first subscribers (each with one share) are:—G. Lomas, 13, Blakeney Road, Sheffield, engineer; F. H. Jackson, 3, Grasmere Drive, Liscard, iron and steel merchant; W. H. Broad, 18, Princes Road, Liverpool, traveller; F. T. P. Deyes, 5, Cook Street, Liverpool, chartered accountant; J. A. Galley, 16, Harlech Road, Blundellsands, inspector; T. E. Cowley, 18, Stuart Road, Waterloo, estate agent; and H. C. Hall, Clyde Villa, Higher Babington, accountant. No initial public issue. The number of directors is not to be less than three or more than seven; the subscribers are to appoint the first; qualification, £100; remuneration as fixed by the company. Registered office, 1, Hampden Buildings, 11, South Castle Street, Liverpool.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Easton Lift Co., Ltd. (81,115).—This company's annual return, made up to July 3rd, was filed on October 1st. The entire capital of £25,000 in 5,000 "A" preference, 5,000 "B" preference, and 15,000 ordinary shares of £1 each, has been taken up. £10,000 has been paid on the "A" and "B" shares, and £15,000 is considered as paid on the ordinary. Mortgages and charges: £4,000.

Brush Electrical Engineering Co., Ltd. (29,533).—This company's annual return was filed on September 12th, when 105,731 ordinary and 150,000 preference shares had been taken up out of a nominal capital of £660,000 in 180,000 ordinary, and 150,000 preference shares of £2 each. £2 per share has been called up on 35,817 ordinary and 78,463 preference, and £228,560 has been received. £282,902 is considered as paid on 69,914 ordinary and 71,587 preference. Mortgages and charges: £250,000.

D. Santoni & Co. (1906), Ltd. (Electrical engineers, London) (89,277).—Memoranda of satisfaction in full (*a*) of debentures dated June 3rd and 22nd, July 5th and 20th, and August 3rd, 1907, securing £2,750, and (*b*) of a second debenture dated September 3rd, 1907, securing £330, have been filed.

May-Oatway Fire Appliances, Ltd. (London).—Issue on October 9th of £4,950 6 per cent. debentures, part of series created same date to secure £5,000, charged on the company's undertaking and property, present and future, including uncalled capital. No trustees.

Brentford Electric Supply Co., Ltd. (81,399).—This company's annual return, made up to January 14th, was filed on September 17th. 7 shares have been taken up out of a nominal capital of £1,000 in £1 shares. No calls have been made. Mortgages and charges: Nil.

Electrolytic Alkali Co., Ltd. (64,360).—Issue on October 16th of £400 4½ per cent. first mortgage debentures, part of series created July 9th, 1904, to secure £50,000, charged on the company's undertaking and property, including uncalled capital. Trustees: Liverpool Mortgage Insurance Co., Ltd. Previously issued of same series: £32,700.

Reed's Electrical Co., Ltd. (93,493).—This company's statutory report, made up to August 20th (filed August 28th), shows 6,607 shares taken up, out of a nominal capital of £8,000 in £1 shares. 6,600 are issued as fully paid. No mortgages or charges registered.

Chloride Electrical Storage Co., Ltd. (35,389).—This company's annual return was filed on October 3rd, when 62,000 preference, and 33,250 ordinary shares had been taken up out of a nominal capital of £135,250 in £1 shares (62,000 preference, 32,250 ordinary, and 40,000 unclassified). £1 per share has been called up on 48,750 preference, and 16,250 ordinary, and £65,000 has been received. £80,250 is considered as paid on 13,250 preference, and 17,000 ordinary. Mortgages and charges: Nil.

South American Railway Construction Co., Ltd. (91,734).—A memorandum of satisfaction in full of a mortgage and debenture dated August 29th, 1907, securing £20,000, has been filed.

CITY NOTES.

Western Telegraph Co., Ltd.

Sir John Wolfe Barry, K.C.B. (chairman), presided over the 68th ordinary general meeting of the above company, held at Electra House, E.C., on Wednesday.

In moving the adoption of the report (see Electrical Review, October 25th, page 701), the Chairman said he thought it would prove gratifying. Compared with the corresponding period of 1906 the message receipts for the six months ending June 30th last showed an increase of £5,799; the interest on reserve fund investments an increase of £4,613, and the increase in dividends on investments in other telegraph companies an increase of £1,015, a total of £11,427. From this had to be deducted a small decrease of £293 in the interest on deposits, leaving a net increase in revenue of £11,132. He regretted, however, that this increase had been nearly absorbed by additional working expenses. The London expenses had decreased by £80, but those at the stations had increased by £6,209, largely owing to increased salaries and wages. The net increase in the expenses was £10,123. A quarterly interim dividend amounting to £31,189 had been paid, £85,000 had been transferred to the general reserve, £5,000 to the maintenance of ships' reserve fund, £10,000 to the Marine insurance fund; and £10,000 to the lands and buildings depreciation fund. The directors now recommend the declaration of a dividend of 3s. per share, making with the interim dividend a total dividend of 6 per cent. for the year, and also the payment of a bonus of 2s. per share free of income-tax. This altogether would amount to £51,982, leaving a balance of £6,864 to be carried forward. They would see in the balance-sheet that the investments at cost were £1,193,497, but at present market prices these investments showed very considerable depreciation. It had been the practice of their company, as with other companies, to state the amount of the investments at cost price, and this had always been prominently stated in the published accounts. Now, however, the depreciation had been so great that it was unsatisfactory, and the question of how it should be dealt with was now under the consideration of the board, and probably the matter would be provided for in the next accounts. They had all seen statements in the Press as to the opening of a system of wireless telegraphy between Ireland and Canada. They were told that one ought not to prophesy before one knew, and he was not by any means anxious to obtrude his views, but on the other hand, he had been asked as their chairman for his views, and he felt it to be somewhat of a duty not to refuse to say what he thought on a subject which touched their interests, although he would have preferred to adopt the safer and more congenial policy of silence, and to await the verdict of the logic of events. He felt bound, however, to say at once that so far as he could judge he did not look upon any system of wireless telegraphy as a serious competitor with their cables. Years ago he said the same thing, and nothing had since occurred to alter his views, nor did he think that the views of the experts whom they then consulted had become different. At that time the length over which wireless messages were sent was, perhaps, 300 or 400 miles, but he then said that he did not put any bounds in that respect to the development of science, and that greater distances would probably be compassed. The fundamental difficulties and imperfections of wireless telegraphy, however, remained in the want of certainty of transmission, the want of secrecy, and in the confusion which must occur when numerous messages were not conveyed by a direct conductor such as a landline, or a telegraph cable from point to point, but were thrown with great violence up into the ether into which they radiated in all directions, to be disentangled and interpreted at the other side of the globe. He was well aware that by tuning or syntonising the receiving instruments to the wave length of the sending instruments, some of these difficulties of publicity and confusion could be met, and, to a limited extent, this was the case. Secrecy, however, was only really attainable so long as third parties abstained from tuning their instruments to intercept the messages; a process, which he was told on the highest authority, presented no difficulty. It was also evident that confusion of simultaneous messages in the ether could be lessened by tuning, but here, again, they must remember that the number of gradations of tuning was limited to an extent which seemed to him to be quite incompatible with the requirements of a large telegraphic business. He believed that some 25,000 paying words passed to and from this country by cables during a busy hour, and they knew that New York expected to receive and answer Stock Exchange telegrams with London in four or five minutes. After making all allowances, for possible tuning, he could not but think that the confusion in the ether would be worse confounded if any considerable number of wireless messages were attempted. With regard to certainty of transmission, he believed that many disturbances of the ether by natural causes must always be encountered, and that the longer the distances attempted, the more formidable would be the difficulties from atmospheric and magnetic causes. Then again, he understood that a wireless sending station of high power could not, as was the case with telegraphy by continuous cables and wires, be at the same time a receiving station, or, in other words, messages could not be sent and received simultaneously, and if this were so, he foresaw the greatest difficulties in dealing with one of the matters which caused constant trouble with any system of telegraphy, viz., the elimination and correction of errors, and the consequent demands for repetition of doubtful signals. For these and other reasons, he did not look upon a wireless system as a serious competitor with cables. He was as much an admirer of the wonderful results obtained by wireless telegraphy as anyone, and appreciated most highly the efforts of those who had shown the way in this very interesting development of science, but he remained of his original opinion as to its practical effect on cable enterprise, so far at least as he could form a judgment under the abnormal conditions of secrecy which had from the first enshrouded the operations of those who had the conduct of the wireless system. Wireless telegraphy would assuredly be of great value to the world in certain localities and for certain purposes, but he thought that instead of being harmful to cable enterprise it might, on the contrary, be an assistance. Indeed, they were now engaged under their concession from the Portuguese Government in an important subsidiary wireless installation for moderate distances in a locality in which a system of cable was, for various reasons, difficult and undesirable. It had been well said that if the order of discovery had been reversed, and cables had come second in point of date to a wireless system, it would have been universally recognised that cables were a fundamental and enormous improvement, eliminating the difficulties under which a wireless system must labour. If one might judge from the activity of foreign Governments and foreign speculators, to say nothing of those of their own country, who were laying cables or seeking for concessions for cables in many parts of the globe, the opinions which he had ventured to enunciate were not different from those of others, and he thought that their company ran more risk from the competition of cables and of consequent depletion of revenue by activities of this sort, than from the development of wireless telegraphy. But this element of competition was one which had been more or less present since the establishment of the company, and was not peculiar to cable business. It was indeed a factor which had to be reckoned with in the management of all successful commercial undertakings.

Sir John Denison-Pender seconded the motion.

A discussion followed, which was chiefly devoted to the question of the depreciation of securities, and the board were asked to pause before commencing a system of writing up and down the values of securities. It was pointed out that in the current year they would be investing £10,000 in securities, which could not very well go lower in value but which should appreciate in value.

The Chairman, in reply, said probably what they would do would be to make provision for any loss which might arise on realisation. They had to sell securities when a cable had to be repaired at considerable expense, and this might cause a loss.

The report was adopted.

South Wales Electrical Power Distribution Co.

This company called a meeting of the principal power users in and around Cwmbran, Pontypool, Abersychan, Abercarn and Cross Keys for Monday last, at Newport. The question before the meeting was a proposal to form a limited liability company, similar to that which has already been formed for the Treforest area of the South Wales Electrical Power Distribution Co., for the purpose of carrying on the Cwmbran generating station, and also to make certain additions to the plant and to the mains in order to put the station into a thoroughly satisfactory condition for safe and economical production and distribution of electricity in the district.

Mr. W. Gascoyne Dalziel, the Chairman of the company, presided, and for the following report of his statement we are indebted to the *Western Mail* for October 29th.

The Chairman gave a financial history of the South Wales Co., the available funds of which were exhausted in May, 1906. The four generating stations had only been kept going since that time at the expense of the principal consumers, the stations being at Treforest, Bridgend, Neath, and Cwmbran. A new company, called the Treforest Electrical Consumers Co., Ltd., with a nominal capital of £100,000, and consisting up to the present time of five of the principal consumers, had entered into an agreement with the South Wales Co. and the debenture-holders of that company to take over the working of the concern in the Treforest area. The new Treforest Co. have to find whatever capital expenditure they consider necessary (now estimated at £30,000) to complete and increase the capacity of the Treforest station and the mains. It had been arranged that the board of directors of the South Wales Co. should consist of five members nominated by the Treforest Consumers Co., Ltd., two members nominated by the debenture-holders, and one nominated by the creditors, nearly all of whom have agreed to become preference shareholders of the South Wales Co. in full satisfaction of their claims. There are also two vacancies retained upon the board for the nominees of a Cwmbran Consumers Co., Ltd., if such company could be formed. The stations at Bridgend and Neath were being sold outright to the respective local authorities, who had provisional orders granted by the Board of Trade. With reference to the Cwmbran station, it was possible to arrange a satisfactory scheme, as had been done in the Treforest case. The Treforest Electrical Consumers Co. were promoting a Bill in Parliament in the coming session in conjunction with the South Wales Co. confirming the arrangements and completely securing the whole position. The Cwmbran station and mains cost about £161,000. The plant included twelve Lancashire boilers, of which at present only six are connected up and in use, four engines and alternators of 300-kw. capacity each (one of which, however, is not yet erected), and one engine of 750 kw., making a total of 1,950 kw. The station could easily deal with a continuous output of 1,200 kw., and supply motors connected to the mains to the total extent of 2,280 kw.—or, say, 3,050 h.p. He thought it was probable that over 2,000,000 units per annum would be sold. Beyond those already supplied with power, other users had indicated a desire to take supplies

from the company, and it seemed certain that if arrangements could be made to prevent the whole concern from shutting down there would be a considerable increase in the demand. There was a cooling tower at Cwmbran, but the condensing plant which the company intended to put in was never delivered, owing to the financial difficulties which arose. The cost of completing the station would be some £5,000 to £6,000, but there were certain improvements necessitating a further expenditure of about £1,200. All that was required, therefore, was the formation of a limited company which would find, roundly, £7,000, and the adherence of sufficient consumers to bring in the necessary revenue. Such a company could then enter into the same working agreement as in the case of the Treforest consumers.

Mr. Hugh Bramwell, chairman of the Treforest Consumers Co., stated that it was intended to have a fixed charge of £5 per horse-power per annum on the maximum horse-power in any one hour, and 1d. per unit.

Mr. Chamen, the general manager of the South Wales Co., answered a number of technical questions with regard to the estimated cost of the station.

After some discussion, it was decided by those present to recommend their respective companies to form a limited company for carrying on the Cwmbran generating station similar to that formed in the case of the Treforest area. Arrangements were made for definite information to be obtained from the various companies who would be prepared to join the scheme, so that full details might be prepared and set before the prospective members of the proposed new company as soon as possible.

Cuba Submarine Telegraph Co., Ltd.

The seventy-second ordinary general meeting of the above company was held on Wednesday at the offices, 58, Old Broad Street, Mr. C. W. Parish presiding.

The Chairman, in moving the adoption of the report (see Electrical Review, October 25th, p. 701), expressed the regret of the board at the absence, through illness, of Mr. J. Scott, the secretary. The report was a satisfactory record of a good half-year's work. At the last meeting he mentioned that the serious earthquake which had caused such destruction to life and property in Jamaica at the beginning of this year, had brought about a heavy increase in the Press and general messages, and that their earnings had been exceptionally large in consequence. As a matter of fact, they amounted in last January to £5,997, as against £3,163 in January of 1906. This gave them a good start, and for the six months which the accounts dealt with, their total traffic came out at £23,106, against £17,638 last year—an increase of £5,468. The working expenses were much the same in the two half-years. Owing to the increase of traffic, the salaries and wages showed an increase of nearly £300, but, on the other hand, depreciation of stores and other items was rather less, so that the increase in the expenses worked out at under £200. They had also received £1,642 as interest from their investments, which was an increase of £191 over last year. The net result was that with the £6,791 brought forward, they had £24 975 to deal with. The dividend for the half-year on the preference shares required £3,000, and after putting £5,000 to reserve and setting aside £5,675 to the special reserve fund for depreciation in the value of their securities, they were able to propose a dividend at the rate of 6 per cent. per annum on the ordinary shares for the half-year. They were very pleased to be able to recommend that increased dividend, especially as they were making provision with regard to their reserve fund for investments. Ten years ago they had a reserve fund of £8,000 against loss on their deposits with certain banks, and although they recovered those deposits better than they at one time anticipated, yet on the voluntary liquidation of the New English Bank of the River Plate, their reserve fund was reduced to £4,343. In view of the continued depreciation of all classes of securities, the board thought it prudent to increase that special reserve fund to £10,000. If, as he hoped, the value of the shares returned to their normal level before the investments had to be realised, they would, of course, profit by that extra reserve, while if, unfortunately, there should be a loss on the securities when sold, at all events it would be recognised that some provision had been made to meet the case. He was sorry to say that they had not received their subsidy for the coast cables. Having failed to obtain payment from the Cuban Government they had now applied to the Spanish Government at Madrid. They were receiving every assistance from the Foreign Office and the British Ambassador at Madrid, and he hoped that eventually their perfectly just claim would be settled. As to their present and future prospects, he had made it clear that the traffic for the first six months of the year was exceptional, and during July, August and September, they estimated that the traffic would be found better than for the same months in 1905, although less than those of last year, which were unduly inflated. So far as they had gone, he saw no reason to anticipate any exceptional earnings. Last April he called their attention to two new cables which were coming down from New York to the Island of Cuba, and those cables had now been completed. One had been laid by the Commercial Cable Co. from New York to Havana, and the other by the Central of South American Cable Co. from New York to Colon, and touching at Guantanamo in Cuba. He could not tell what influence these cables would have on their business, but it was important that they should strengthen their position in every way so as to be ready to meet any calls which might be made upon them in the future, and any eventualities which might arise.

Mr. George Keith seconded the motion.

Replying to questions put by shareholders, the Chairman said that the new cables had practically only just started, and so far had had no influence on their cables at all, but they had no arrangements with these new companies, nor could they have, owing to existing agreements. Their cables were laid in groups, and it was inconceivable that they would all break at the same time. To replace their longest length of cable would make a big hole in £100,000, and that was what they had provided their reserve fund for. He was not a technical man, but so far wireless telegraphy had not interfered with his sleep at all. He had asked clever people about it, and they thought that if there was any great advantage in the system that Mr. Marconi claimed for it, the shares in the wireless undertakings would stand at a higher figure, and the companies would have made more headway. Personally, he would rather have his money in the Cuba Submarine Co. than in wireless telegraphy companies.

The motion was then carried, and a vote of thanks to the directors and staff concluded the proceedings.

Electrolytic Alkali Co., Ltd.

The directors' report for the year ended August 31st states that the net profit for the year, after allowing for depreciation, mortgage debenture interest, and expenditure on renewals, repairs and general upkeep of buildings, plant, machinery, tools, &c., is £8,212, plus £2,127 brought forward, making a total of £10,339. The hope expressed in the last annual report, that further developments during the ensuing year would show better results, has not been realised. The causes of this result have been entirely beyond the control of the board, the further increase during the year in the price of fuel, packages and other commodities which form the chief items of cost of the company's manufactures, being mainly responsible for the decreased profit. The market prices of the company's products are abnormally low compared with those of other heavy chemicals, and the company has not participated in the advanced prices which were obtained during the period in other branches of their trade. Notwithstanding the result now shown, the directors have the fullest confidence that when normal prices have been re-established the company will be able to make a satisfactory return to all the shareholders. Two and a half years' dividend on the preference capital has now accrued; but in view of the unsettled state in that portion of the chemical trade in which the company is engaged, the directors think the wisest course is to pay only one half-year's dividend upon such shares; £6,840 is to be carried forward. The erection of the additional plant is nearing completion. It has not been possible to get any benefit from this during the past year, while the expense of issuing debentures needed to pay for such plant, and the interest on them, have been charged against revenue. The same rates of depreciation as in past years have been maintained, and an increased amount for renewals and repairs necessary to keep the buildings, plant, machinery and tools in a high state of efficiency, is also charged against the year's revenue. The demand for the products of the company is eminently satisfactory. The directors hope to have the new installation in operation at an early date, when they will be in a better position to deal with the increased volume of business which has already been secured.

Stock Exchange Notice.—Application has been made to the Committee to allow the following to be quoted in the Official List:—South Metropolitan Electric Tramways and Lighting Co., Ltd.—19,570 6 per cent. cumulative preference shares of £1 each, fully paid. Nos. 1 to 19,570.

Prospectus.—*The Canadian General Electric Co., Ltd.*—On behalf of this company Messrs. Sperling & Co. were yesterday to open and close the list of applications for an issue of $2,000,000 7 per cent. cumulative preference stock in shares of $100 each at par, or £20 11s. per share. The company has, of course, very wide and various manufacturing interests in Canada, and the rapid development of all departments of the business led last year to the decision to construct extended factory buildings. It is to meet the cost of these, to redeem outstanding 6 per cent. preference stock, and to pay off bank overdraft.

Stirling and Bridge of Allan Trams Co., Ltd.—The total earnings for the past year amounted to £5,475, an increase of £222. The balance at credit revenue is £1,003. A dividend of 4 per cent. (less income-tax) is declared on the preferred and second preferred shares and one of 4 per cent. (free of income-tax) on the ordinary shares, carrying £241 to renewal account. The National Electric Construction Co. have been unable to come to terms with the local authorities, and the provisional agreement with that company for the purchase of the tramway company's undertaking had fallen through.

Bukit Rajah Rubber Co.—The directors have declared an interim dividend of 10 per cent. (2s. per share), less income-tax, on the ordinary shares.

Craigpark Electric Cable Co., Ltd.—The directors have declared an interim dividend on the preference shares for the six months ended September 30th at the rate of 6 per cent. per annum.

MARKET QUOTATIONS.

Wednesday, October 30th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	5/-	..
a ,, Nitric	per cwt.	22/-	..
a ,, Oxalic	per cwt.	88/-	..
a ,, Sulphuric	per cwt.	5/6	..
a Ammoniac, Sal	per cwt.	42/-	..
a Ammonia, Muriate (crystal) ..	per ton	£33 10	..
a ,, ,, ...	per ton	£30	..
a Bleaching powder	per ton	£5 10	..
a Bisulphide of Carbon	per ton	£18	..
a Borax	per ton	£16	..
a Copper Sulphate	per ton	£22 10	£1 15 dec.
a Lead, Nitrate	per ton	£31	£1 dec.
a ,, White Sugar..	per ton	£32	£3 dec.
a ,, Peroxide	per ton	£32	..
a Methylated Spirit	per gal.	2/6	..
a Potassium Bichromate, in casks	per lb.	3½d.	..
a Potash, Caustic (75/80 %) ..	per ton	£20	..
a ,, Chlorate	per lb.	3½d.	..
a ,, Perchlorate	per lb.	9d.	..
a Potassium Cyanide	per lb.	7d.	..
a Shellac	per cwt.	220/-	..
a Sulphate of Magnesia	per ton	£4 10	..
a Sulphur, Sublimed Flowers ..	per ton	£6 10	..
a ,, Recovered	per ton	£5 10	..
a ,, Lump	per ton	£5	..
a Soda, Caustic (white 70 %) ..	per ton	£10 15	..
a ,, Chlorate	per lb.	3½d.	..
a ,, Crystals	per ton	£3 5	..
a Sodium Bichromate, casks ..	per lb.	3d.	..
a ,, Cyanide (basis 100 %) ..	per lb.	7d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots ..	per ton	£176 5	£43 15 dec.
b ,, Wire, in ton lots ..	per ton	£154	£23 dec.
b ,, Sheet, in ton lots ..	per ton	£144	£19 dec.
p Babbitt's metal ingots	per ton	£55 to £156	dec.
c Brass (rolled metal 2" to 12") basis	per lb.	7½d.	½d. inc.
c ,, Tube (brazed)	per lb.	9½d.	..
c ,, ,, (solid drawn).. ..	per lb.	8d.	..
c ,, Wire, basis	per lb.	7½d.	..
c Copper Tubes (brazed)	per lb.	10½d.	..
c ,, ,, (solid drawn) ..	per lb.	10½d.	..
g Copper Bars (best selected) ..	per ton	£82	inc.
g Copper Sheet	per ton	£82	£3 inc.
g ,, Rod	per ton	£82	inc.
c ,, (Electrolytic) Bars ..	per ton	£89	£5 inc.
c ,, ,, Sheets ..	per ton	£86	£4 inc.
c ,, ,, Rod ..	per ton	£74	£5 inc.
c ,, ,, H.C. Wire	per lb.	8½d.	½d. inc.
f Ebonite Rod	per lb.	8/8	..
f ,, Sheet	per lb.	8/-	..
n German Silver Wire	per lb.	1/7	..
h Gutta-percha, fine	per lb.	5/6 to 6/6	..
h India-rubber, Para fine	per lb.	4/1½	1d. dec.
i Iron, Charcoal Sheets	per ton	£18	..
i ,, Pig (Cleveland warrants)	per ton	53/1½	1½d. inc.
i ,, Forgings, according to size	per ton	From £11	..
i ,, Scrap, heavy	per ton	47/6 to 50/-	..
i ,, Wire, galvanised No. 8 ..	per ton	£9 15	..
g Lead, English Ingot	per ton	£18 15	dec.
g ,, ,, Sheet	per ton	£18 17 6	15/- dec.
m Manganin Wire No. 28	per lb.	8/-	..
g Mercury	per bot.	£8 5	..
d Mica (in original cases) small ..	per lb.	6d. to 1/-	..
d ,, ,, ,, medium	per lb.	2/6 to 4/-	..
d ,, ,, ,, large ..	per lb.	4/6 to 8/6	..
p Phosphor Bronze, plain castings	per lb.	1/1½ to 1/8	1d. dec.
p ,, rolled bars & rods	per lb.	1/2 to 1/4	dec.
p ,, ,, strip & sheet	per lb.	1/2¼ to 1/5	dec.
o Platinum	per oz.	110/-	..
e Silicium Bronze Wire	per lb.	10d.	..
r Steel, Magnet, in bars		£60	..
g Tin, Block (English)	per ton	£147 to £148	£6 inc.
n ,, Wire, Nos. 1 to 16	per lb.	2/-	..
p White Anti-friction Metals—			
"White Ant" brand	per ton	£45 to £70	..
k Zinc, Sh't (Vieille Montagne bnd.)	per ton	£26 10	10/- inc.

Quotations supplied by:—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d F. Wiggins & Sons.
e Frederick Smith & Co.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
i Bolling & Lowe.
k Morris Ashby, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p The Phosphor Bronze Co., Ltd.
r W. F. Dennis & Co.

Metallic Seamless Tube Co., Ltd.—Mr. W. Neale, who presided at the meeting of this company on October 25th, in moving the adoption of the report (see ELECTRICAL REVIEW, October 25th, page 701), referred to the reduction of the net profit by £500, and said that this was due to the prevalence in their trade of cut-throat competition, which had lessened prices. They had done rather more business and got less profit. The balance-sheet, considering the circumstances, was very satisfactory.

Norwich Electric Tramways Co., Ltd.—According to the *Financial Times*, the accounts for the year to June 30th show, including £372 brought down, net profits of £8,419. Having placed £1,000 to reserve (making it £8,196), a dividend of 1¾ per cent. is recommended, carrying forward £159.

STOCKS AND SHARES.

Tuesday Evening.

MONEY and American Rails are the chief planets for the time being in the financial firmament. Both combined to upset markets considerably. The New York crisis, which narrowly escaped being a thorough panic, exercised a strong restraint upon general business, and, in addition, caused realisations by nervous holders of stock owning any sort of connection with the United States. The monetary situation gave the markets a spasm on Monday, when confident statements went round that the Bank Rate was about to be raised immediately. So that, what with one thing and another, it cannot be said with any truthfulness that the markets had been ultra-bullish.

Last Saturday morning's deplorable accident at West Hampstead, in the fog, caused the price of Metropolitan Railway Consolidated to drop two points to 31, but since then there has been a rally to 33½, apparently due to closing by bears. The immunity of the Metropolitan Company hitherto from fatal accidents had come to be regarded as one of the few strong points in favour of the stock, but the evidence of the signalmen at the inquest on Monday is, at least, disquieting, unless it leads to a useful overhaul of the mechanism connected with the signals.

Districts have dropped back somewhat to 11, and the profit notes of the Underground Railways of London are two points lower at 46½. Central Londons continue very dull, all three issues falling sharply; City and South London went back to 45.

By the suspension, said to be temporary, of two Westinghouse undertakings in Pittsburg, U.S.A., the issues of the British Westinghouse Electric and Manufacturing Company were acutely depressed. The Debenture stock fell nominally to 55, but was not worth as much even as that, judged by the standard of what it would fetch. The Preference shares fell to 15s. It is no secret that the debenture interest had to be helped by the American companies, and the idea that these contributions might come to an end was a natural outcome of the suspension of the United States concerns.

Careful study of the last balance-sheet, however, shows that if a most generous allowance be made for writing-down the assets, the remainder will be found to cover, and with a reasonable margin, something like 80 per cent. of the Debenture issue of rather over a million sterling. No doubt it was some such consideration which sent a few buyers into the market, raised the Debentures to 60, and put Preference shares upon a better basis at 22s. 6d.

With regard to the Canadian General Electric new issue, business in the existing common stock is being done at about 104. Mexican Light and Power capital stock hardened to 41½.

Electricity supply shares are quiet, with scarcely any outstanding feature. Charing Cross Preference have been marked down ½ and County Preference were raised ¼. Kensington and Knightsbridge Debenture improved a point, and this concludes the alterations in the price list this week.

Telegraph stocks cannot get over the Marconi shock, though the slump is checked. The crisis in New York affected this department but little. Cable companies have been busy in consequence of the additional traffic that the various developments in Wall Street brought to the lines, but a remarkable feature of the latest sensation was the temporary stoppage of all Stock Exchange arbitrage business between London and New York on two evenings, owing to money rates touching 75 to 125 per cent. on the other side of the water. Anglo-American Ordinary and Commercial Cable Debenture stocks are both lower. Great Northerns dropped £2, and one or two of the Debentures eased off. The only shares to exhibit a rise are Direct United States, which hardened to 13. Marconis gave way to 17s. 6d.

Telegraph Trust issues remain fairly firm. Globe Ordinary fell to 9½, but the two Mackay stocks have not moved, both being somewhat nominal at the quoted levels.

The Traction group shows dulness. Anglo-Argentine Second Preference—the old Ordinary shares—declined to 7¾. Calcuttas gave way, and British Electric Tractions continued to dwindle. Manufacturing shares are quiet and steady.

Change in the Bank Rate.—The Bank rate was yesterday raised from 4½ to 5½ per cent.

Belgium.—La Société Liégeoise d'Electricité of Liége reports a profit of £11,566 for the last financial year, and is declaring a dividend of 25 fr. per share, the same as for the preceding 12 months.

West India and Panama Telegraph Co., Ltd.—Dividends of 6s. per share on the first preference for the half-year to June 30th, and 20s. per share on the second preference (on account of dividends accrued) are recommended.

SHARE LIST OF ELECTRICAL COMPANIES.

TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share. *	Dividends for the last four years. 1903.	1904.	1905.	1906.	Closing Quotations Oct. 22nd.	Closing Quotations Oct. 29th.	Business done week ended Oct. 29th, 1907. Highest	Lowest.	Rise + or Fall —	Present Yield per cent. £ s. d.
25,000	Amazon Telegraph Co.'s shares, Nos. 1 to 25,000	10	Nil	Nil	Nil	..	3 — 3⅛	3 — 3⅛	..	..	..	Nil
149,600	Do. do. 5 % Debs., Nos. 1 to 1,250 Red.	100	Nil	Nil	5 %	5 %	85 — 88	85 — 88	..	..	..	5 13 8
660,660	Anglo-American Telegraph	Stock	61s.	2½%	3½%	3⅜%	52 — 55	51 — 54	52	51	—1	7 3 6
3,169,670	Do. do. do. 6 % Pref.	Stock	6 %	5⅜%	6 %	6 %	91 — 94	91 — 94	92⅜	91	..	6 7 8
3,169,670	Do. do. do. Deferred	Stock	2s.	Nil	⅛%	1⅜%	13⅛ — 14	13⅛ — 13⅝	13⅞	13 5/16	— ⅛	12 14 0
50,000	Anglo-Portuguese Tel., 5 % Mort. Deb. Stock Red.	100	..	..	3 %	5 %	99 —102	99 —102	..	..	..	4 18 0
44,000	Chili Telephone, Nos. 1 to 44,000	5	7 %	8 %	8 %	8 %	6⅞ — 7⅛	6⅞ — 7⅛	..	..	..	5 10 4
2,097,680	Commercial Cable Sting. 500 year 4 % Deb. Sk. Red.	Stock	4 %	4 %	4 %	4 %	90 — 92	89 — 91	90½	..	—1	4 7 11
16,000	Cuba Telegraph	10	0 %	5 %	5 %	5 %	6 — 7	6 — 7	..	..	..	7 2 10
6,000	Do. 10 % Pref.	10	15 %	10 %	10 %	10 %	15⅞ — 16⅞	15⅞ — 16⅞	..	..	..	5 19 5
12,981	Direct Spanish Telegraph, Ord.	5	4 %	4 %	4 %	4 %	3⅛ — 3⅜	3⅛ — 3⅜	..	..	..	5 14 3
6,000	Do. do. 10 % Cum. Pref. ..	5	10 %	10 %	10 %	10 %	9 — 9⅛	9 — 9⅛	..	..	..	5 5 9
30,000	Do. do. 4½ % Debs.	50	4½%	4½%	4½%	4½%	98 —101	98 —101	..	..	..	8 18 2
60,710	Direct United States Cable	20	3 %	3½%	4½%	4½%	12 — 13	12⅛ — 13⅛	13½	12½	+ ⅛	6 19 1
57,000	Direct W. India Cable, 4½ % Reg. Deb., 1 to 1,200, R.	100	4½%	4½%	4½%	4½%	100 —102	100 —102	..	..	..	4 8 3
4,000,000	Eastern Telegraph, Ord. Stock..	Stock	7 %	7 %	7 %	7 %	121 —126	120 —125	124	121	—1	5 12 0
2,000,000	Do. 3½ % Pref. Stock..	100	3½%	3½%	3½%	3½%	83½ — 86½	80 — 83	82½	81	—3½	4 4 4
1,896,706	Do. 4 % Mort. Deb. Stock. Red. ..	Stock	4 %	4 %	4 %	4 %	101 —104	101 —104	101	..	..	3 16 11
300,000	Eastern Extension, Australasia, and China Tele.	10	7 %	7 %	7 %	7 %	11 — 12	11 — 12	11½	11	..	5 16 8
752,400	Do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %	99 —102	99 —102	..	..	..	3 18 5
295,400	East & S. Afric. Tel., 4 % Mt. Db., 1 to 3,000, red. 1909	100	4 %	4 %	4 %	4 %	97½ —100½	97⅛ —100⅛	..	..	..	3 19 7
200,000	Do. 4 % Reg. M. Debs. (Mauritius Sub.) 1 to 3,000	25	4 %	4 %	4 %	4 %	100 —102	100 —102	100½	..	..	3 18 5
181,127	Globe Telegraph and Trust	10	5⅛%	5⅛%	5⅛%	5⅛%	9½ — 10½	9 — 10	9½	..	— ½	5 10 0
181,127	Do. do. 6 % Pref..	10	6 %	6 %	6 %	6 %	12 — 13	12 — 13	..	..	..	4 12 4
150,000	Great Northern Telegraph, of Copenhagen.. ..	10	15 %	24 %	24%	20 %	34 — 36	32 — 34	..	..	—2	5 17 8
28,900	Halifax and Bermudas Cable, 4½ % 1st Mort. Debs., within Nos. 1 to 1,200, Red.	100	4½%	4½%	4½%	4½%	100 —102	99 —101	..	..	—1	4 9 1
17,000	Indo-European Telegraph	25	10 %	13 %	13 %	13 %	54 — 56	54 — 56	..	..	..	5 16 1
$41,380,400	Mackay Companies Common	$100	..	1 %	2 %	3½%	50 — 60	50 — 60	..	..	..	6 16 8
$50,000,000	Do. do. 4% Cum. Pref.	$100	..	4 %	4 %	4 %	50 — 60	50 — 60	..	..	..	6 13 4
256,127	Marconi's Wireless Telegraph	1	Nil	Nil	Nil	..	⅞ — 1⅛	1 — 1	21/3	18/9	— ⅛	Nil
72,680	Monte Video Telephone Co., Ltd. Ord.	1	3 %	4 %	5 %	6 %	1⅛ — 1 1/16	1⅛ — 1 1/16	..	..	..	4 14 1
86,492	Do. do. do. 5 % Pref. ..	1	5 %	5 %	5 %	5 %	⅞ — 1	⅞ — 1	..	..	..	5 0 0
2,225,000	National Telephone, Pref. Stock	100	6 %	6 %	6 %	6 %	106 —108	106 —108	107⅜	106⅜	..	5 11 1
2,225,000	Do. do. Def. Stock	100	5 %	5 %	5 %	5 %	106 —108	106 —108	107⅜	106½	..	4 12 7
15,000	Do. do. 6 % Cum. 1st. Pref.	10	6 %	6 %	6 %	6 %	10⅛ — 12½	10⅛ — 12⅛	12	11⅛	..	4 16 0
15,000	Do. do. 6 % Cum. 2nd Pref.	10	6 %	6 %	6 %	5 %	10 — 12	10 — 12	..	..	..	4 3 4
250,000	Do. do. 5 % Non-cum. 3rd P., 1 to 250,000	5	5 %	5 %	5 %	5 %	5⅛ — 5⅜	5⅛ — 5⅛	5⅛	..	..	4 10 11
2,000,000	Do. do. 3½ % Deb. Stock Red. ..	Stock	3½%	3½%	3½%	3½%	96 — 98	95½ — 97½	96½	..	—1	3 11 10
1,689,598	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	99½ —101½	96½ —101½	..	..	..	3 18 10
179,313	Oriental Telep. and Elec. 1 to 171,504, fully paid ..	1	6⅞%	6⅞%	7 %	7 %	1 3/32 — 1 5/32	1 3/32 — 1 5/32	..	..	+ 3/32	5 6 8
50,000	Do. do. do. 6 % Cum. Pref.... ..	1	6 %	6 %	6 %	6 %	1 1/16 — 1 1/16	1 1/16 — 1 1/16	..	..	..	4 11 5
100,000	Do. do. do. 4 % Red. Deb. Stock ..	100	..	..	4 %	4 %	91 — 94	91 — 94	..	..	..	4 5 1
100,000	Pacific & European Tel., 4 % Guar. Debs., 1 to 1,000	10	4 %	4 %	4 %	4 %	97 —100	97 —100	..	..	..	4 0 0
11,839	Reuter's	8	5 %	5 %	5 %	5 %	7 — 8	7 — 8	..	..	..	5 0 0
60,000	Telephone Co. of Egypt, 4½ % Deb. Red.	100	..	..	4½%	4½%	98 —101	98 —101	..	..	..	4 9 1
3,167	Submarine Cables Trust	Cert.	6 %	6 %	6 %	6 %	124 —127	124 —127 xd	..	..	..	4 14 6
80,000	United River Plate Telephone	5	8 %	8 %	8 %	8 %	6⅜ — 7⅛	6⅜ — 7⅛	..	..	..	5 10 4
40,000	Do. 5 % Cum. Pref., Nos. 1 to 40,000	5	5 %	5 %	5 %	5 %	5 — 5⅛	5 — 5⅛	..	..	..	4 10 11
15,609	West African Telegraph, Shares	10	4 %	4½%	4 %	4 %	10 — 10⅛	10 — 10⅛	..	..	..	3 16 2
30,008	W. Coast of America, 1 to 30,000 & 53,001 to 53,008	2	Nil	Nil	Nil	2½%	1⅛ — 1⅜	1 — 1⅛	20/3	..	— ⅛	4 0 0
150,000	Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4 %	4 %	4 %	4 %	97 —100	97 —100	..	..	..	4 0 0
207,930	Western Telegraph, Ltd., Nos. 1 to 207,930.. ..	10	7 %	7 %	7 %	7 %	12½ — 13⅛	12½ — 13⅛	12⅝	12½	..	5 5 8
800,000	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	99½ —101½	99 —102	..	..	..	3 18 5
88,321	West India and Panama Telegraph	10	Nil	Nil	Nil	Nil	7/16 — 9/16	7/16 — 9/16	8/9	..	..	Nil
34,563	Do. do. 6 % Cum. 1st Pref.	10	7 %†	6 %	5 %	8 %	7 — 8	7 — 8	7⅞	..	..	10 0 0
4,669	Do. do. 6 % Cum. 2nd Pref.	10	Nil	Nil	Nil	Nil	6½ — 7½	6½ — 7½	..	..	..	Nil
80,000	Do. do. 5 % Debs., Nos. 1 to 1,800 ..	100	5 %	5 %	5 %	5 %	99 —102	99 —102	..	..	..	4 18 0

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

270,000	Anglo-Argentine Trams, 10 % Nom. Cum. 2nd Pref., 260,008 to 580,097	5	..	8 %	8 %	8 %	7⅞ — 8	7½ — 7⅝	7⅝	7½	— 1/16	5 1 7
260,027	Do. 6 % Cum. Prefs., 1 to 260,007 ..	5	5½%	5½%	5½%	5½%	5⅛ — 6 3/16	5⅛ — 6 3/16	6 3/32	..	..	4 8 11
266,600	Do. Permanent, 6 % Deb. Stock, 1888	100	6 %	6 %	6 %	6 %	131 —134	131 —134	..	..	..	4 9 7
285,100	Auckland E. Trams, 5 % 1st Mort. Deb. Stock ..	100	5 %	5 %	5 %	5 %	102 —105	102 —105	..	..	..	4 15 8
880,000	Babcock & Wilcox, 1 to 880,000..	1	17 %	20 %	20 %	20 %	3⅛ — 3⅜	3⅛ — 3⅜	75/-	73/9	..	5 6 8
100,000	Do. do. 6 % Cum. Pref., 1 to 100,000 ..	1	6 %	6 %	6 %	6 %	1 1/16 — 1 3/16	1 1/16 — 1 1/16	..	..	..	3 16 10
38,000	British Aluminium, Ord., 2,001 to 40,000	5	..	7 %	7 %	7 %	4 — 5	4 — 5	..	..	..	7 0 0
40,000	Do. do. 7 % Cum. Pref.	5	Nil	7 %	7 %	7 %	4⅞ — 5⅛	4⅞ — 5⅛	5 7/16	5⅛	..	6 10 3
20,000	Do. do. "A" 6 % Cum. Pref.	5	Nil	6 %	6 %	6 %	4⅜ — 5	4⅜ — 5	..	..	..	6 0 0
20,000	Do. do. 4 % Funding Certs.	5	..	4 %	4 %	4 %	3⅞ — 4⅛	3⅞ — 4⅛	..	..	..	4 14 1
258,000	Do. do. 5 % 1st Mort. Deb. Stock Red.	Stock	5 %	5 %	5 %	5 %	100 —103	100 —103	..	..	..	4 17 1
300,000	Do. do. 5½ % Loch Leven Debs. ..	100	..	..	..	5½%	96 — 99	96 — 99	..	..	..	5 11 1
400,000	British Columbia E. Rail Def. Ord. Stock	100	6 %	6 %	6 %	6 %	130 —135	130 —135	132½	132	..	4 8 3
300,000	Do. 5 % Pref. Ord. Stock	100	5 %	5 %	5 %	5 %	112 —116	112 —116	113⅜	113	..	4 6 2
300,000	Do. 5 % Cum. Perp. Pref. Stock	100	5 %	5 %	5 %	5 %	104 —107	104 —107	109½	..	..	4 13 6
288,000	Do. 4½ % 1st Mort. Debs., 1 to 6,250	40	4½%	4½%	4½%	4½%	98 —101	98 —101 xd	..	..	..	4 7 5
220,000	Do. 4½ % Vancouver Power Debs., 1 to 2,200	100	4½%	4½%	4½%	4½%	102 —104	102 —104	..	..	..	4 6 7
133,301	British Electric Traction	10	6 %	6 %	3 %	Nil	1⅜ — 2⅛	1⅜ — 2⅛	..	..	..	Nil
161,497	Do. do. 6 % Cum. Pref.	10	6 %	6 %	6 %	6 %	5⅛ — 6	5⅛ — 5⅝	5⅝	5 5/16	— ⅛	10 8 8
1,448,553	Do. do. 5 % Perp. Deb. Stock ..	Stock	5 %	5 %	5 %	5 %	96 — 99	96 — 98	97½	96	—1	5 2 0
410,178	Do. do. 4½ % 2nd Deb. Stock Red.	100	..	4½%	4½%	4½%	78 — 81	76 — 80	..	..	—1½	5 12 6
100,000	British Insulated and Helsby Cables	5	8 %	8 %	8 %	10 %	6¾ — 7	6⅝ — 7	..	..	..	7 2 10
100,000	Do. do. 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	5⅝ — 6⅛	5⅝ — 6⅛	..	..	..	4 18 0
500,000	Do. do. 4½ % 1st Mort. Deb. Red. ..	100	4½%	4½%	4½%	4½%	101 —104	101 —104	..	..	..	4 6 7
212,000	British Thomson-Houston 4½ % 1st Mort. Debs. ..	100	4½%	4½%	4½%	4½%	85 — 89	85 — 89	..	..	..	4 18 11
400,000	British Westinghouse 6 % Pref., 1 to 200,000 and 275,001 to 475,000	5	6 %	Nil	Nil	..	1 — 1⅛	⅞ — 1⅛	..	..	— 1/16	Nil
1,016,358	Do. do. 4 % Mort. Deb. Stock ..	100	4 %	4 %	4 %	4 %	62 — 67	55 — 65	..	..	—4½	6 3 1
50,000	‡Browett, Lindley & Co., Ord.	£1	Nil	Nil	Nil	..	⅜ — ½	⅜ — ½	..	..	..	Nil
50,000	‡ Do. do. 6 % Cum. Pref.	£1	Nil	Nil	Nil	..	14/6 to 15/6	14/6 to 15/6	..	..	..	Nil
105,731	Brush Electrical Engineering, Ord., 1 to 105,731 ..	2	Nil	Nil	2½%	Nil	⅛ — ¼	⅛ — ¼	..	..	..	Nil
150,000	Do. do. Non-cum. 6 % Pref. ..	2	6 %	6 %	6 %	Nil	⅝ — 1⅛	⅝ — 1⅛	..	..	..	Nil
125,000	Do. do. 4½ % Perp. Deb. Stock ..	Stock	4½%	4½%	4½%	4½%	83 — 86	83 — 86	..	..	..	5 4 8
125,000	Do. do. 4½ % Perp. 2nd Deb. Stock..	Stock	4½%	4½%	4½%	4½%	67 — 70	67 — 70	..	..	..	6 8 7
100,000	Buenos Ayres & Belgrano, 1 to 100,000	5	3 %	4 %	3 %	8 %	4 1/16 — 4 3/16	4 1/16 — 4 3/16	90/-	..	..	2 4 0
40,000	Do. do. "A" 6 % Cum. Pref., 1 to 40,000	5	6 %	6 %	6 %	6 %	4⅝ — 5⅛	4⅝ — 5⅛	97/6	..	..	5 14 3
27,500	Do. do. "B" do., 1 to 27,500	5	6 %	6 %	6 %	6 %	4⅝ — 5⅛	4⅝ — 5⅛	..	..	..	5 14 3
13,200	Do. do. 5 % Deb. Stock	100	5 %	5 %	5 %	5 %	105 —115	105 —115	..	..	..	4 6 11
190,000	Do. do. 5 % 2nd Deb. Stock	100	5 %	5 %	5 %	5 %	102 —105	102 —105	..	..	..	4 15 8
137,610	Calcutta Trams, 1 to 137,610	5	6 %	8 %	8 %	8 %	7 — 7⅞	6⅞ — 7⅛	7	..	— ⅛	5 10 4
30,000	Do. 5 % Cum. Pref., Nos. 1 to 29,330..	5	..	..	5 %	5 %	5 — 5⅛	5 — 5⅛	..	..	..	4 10 11
350,000	Do. 4½ % 1st Deb. Stock..	100	4½%	4½%	4½%	4½%	100 —104	100 —104	..	..	..	4 6 7
35,000	Callender's Cable Construction shares	5	12½%	12½%	15 %	15 %	9⅜ — 10⅜	9⅜ — 10⅜	10½	9⅜	..	7 0 0
40,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	5⅛ — 5⅜	5⅛ — 5⅜	..	..	..	4 6 11
300,000	Do. do. 4½ % 1st Mort. Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	105⅛ —107⅛	105⅛ —107⅛	..	..	..	4 2 4
491,222	Cape E Trams., 1 to 491,222	1	10 %	5 %	Nil	..	⅛ — ¼	⅛ — ¼	..	..	..	Nil
450,000	Castner-Kellner Alkali, 1 to 450,000	1	4 %	4 %	6 %	8 %	1 1/16 — 1 1/8	1 1/16 — 1 1/8	26/-	24/9	..	6 1 11
224,988	Do. do. 4½ % 1st Mort. Deb. Stock	100	4½%	4½%	4½%	..	98 —102	9 —102	..	..	..	4 8 3
911,568	Central London Railway, Ord. Stock	Stock	4 %	4 %	4 %	4 %	60 — 62	58 — 60	58½	..	—2	6 18 4
544,216	Do. do. 4 % Pref. Stock	Stock	4 %	4 %	4 %	4 %	87 — 89	85 — 87	..	..	—2	4 12 0
544,216	Do. do. Def. do.	Stock	4 %	4 %	4 %	4 %	42 — 45	40 — 42	..	..	—2	9 6 0
1,480,000	City and South London Railway	Stock	2⅜%	2⅜%	1¾%	2⅜%	45 — 47	44 — 46	46	44½	—1	4 12 5

* Unless otherwise stated, all shares are fully paid. † A period of nine months. ‡ From Manchester Share List.

(Continued on next page.)

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.—(*Continued*)

Present Issue.	NAME.	Stock or Share.	Dividends for the last four years.				Closing Quotations Oct. 22nd	Closing Quotations Oct. 29th.	Business done week ended Oct. 29th, 1907.		Rise + or Fall —	Present Yield per cent.
		*	1903.	1904.	1905.	1906.			Highest.	Lowest.		£ s.
85,000	Crompton & Co., Nos. 1 to 85,000	3	2¼%	2¼%	2¼%	5 %	1⅞— 2	1⅞— 2	..	..	..	7 5 5
100,000£	Do. 5 % 1st Mort. Reg. Debs., 1 to 900 of £100, and 901 to 11,000 of £50 Red.	..	5 %	5 %	5 %	5 %	96 — 99	96 — 99	97½	..	..	5 1 0
260,000	Dick, Kerr & Co., 1 to 260,000	1	..	10 %	10 %	10 %	1⅞— 1⅞	1⅞— 1⅞	28/9	..	..	6 13 4
305,000	Do. do. 6 % Cum. Pref., 1 to 305,000	1	6 %	6 %	6 %	6 %	1 — 1¼	1 — 1¼	..	..	..	4 16 0
294,150	Do. do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	101 —104	101 —104	..	..	..	4 6 7
60,000	Dublin United Trams. (1896), 1 to 60,000	10	5½%	6 %	6%	6 %	13 — 14	13 — 14	..	..	..	4 5 9
59,987	Do. 6 % Pref. between 1 and 60,000	10	6 %	6 %	6 %	6 %	12⅞— 13⅞	12⅞— 13⅞	..	..	..	4 7 3
99,261	Edison & Swan Utd., "A" shs., £3 pd., 1 to 99,261	5	Nil	2½%	4½%	4½%	1 — 1¼	1 — 1¼	21/9	20/7½	..	9 11 1
17,199	Do. "A" shares, 01—017,199	5	Nil	2½%	4½%	4½%	2½ — 2¾	2½ — 2¾	..	..	..	8 6 9
319,475	Do, 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	83 — 85	83 — 85	..	..	..	4 14 2
72,220	Do. 5 % 2nd Deb. Stock Prov. Certs. all pd.	100	5 %	5 %	5 %	5 %	87 — 90	87 — 90	..	..	..	5 11 1
112,100	Electric Contruction, 1 to 112,100	2	4 %	Nil	Nil	Nil	⅛— ⅜	⅛— ⅜	..	..	..	Nil
31,390	Do. do. 7 % Cum. Pref., 1 to 31,390	2	7 %	7 %	7 %	Nil	⅝— 1	⅝— 1	..	..	..	Nil
25,000	General Electric Co. (1900), 5 % Cum. Pref.	10	4 %	5 %	5 %	5 %	8 — 8½	8 — 8½	..	..	..	5 17 8
200,000	Do. do 4 % Mort Deb.	Stock	4 %	4 %	4 %	4 %	90 — 93	89 — 92	..	..	—1	4 19 11
78,000	Gt. N. & City Rail. Pref. Ord. "A" 4 %, 1 to 78,000	10	3 %	4 %	4 %	4 %	1½ — 1⅝	1½ — 1⅝	..	..	..	20 0 0
96,000	Greenwood & Batley, 7 % Cum. Pref.	10	7 %	7 %	7 %	7 %	10¼— 10⅝	10⅛— 10⅝	..	..	..	6 10 3
80,000	Do. do. 5 % Mort. Debs.	100	5 %	5 %	5 %	5 %	102 —103	102 —103	..	..	..	4 17 1
200,000	Henley's (W. T.), Telegraph Works, Ord.	5	15 %	15 %	15%	15 %	10½— 11½	10½— 11½	11	10½	..	6 10 0
200,000	Do. do. 4½ % Pref.	5	4½%	4½%	4½%	4½%	5 — 5½	5 — 5½	..	..	..	8 17 3
150,000	Do. do. 4½ % Mort. Deb. Stock	Stock	4½%	4½%	4½%	4½%	105½—107½	105½—107½	..	..	..	4 3 9
50,000	India-Rubber, Gutta-percha & Telegraph Works	10	10%	5 %	10%	10 %	14½— 15½	14½— 15½	..	..	..	6 13 4
37,500	†Liverpool Overhead Railway, Ord.	10	1⅜%	1½%	Nil	Nil	1⅝ — 1⅞	1⅝ — 1⅞	..	..	..	Nil
10,000	† Do. do. Pref., fully paid	10	5 %	5 %	5 %	5 %	7½ — 8	7½ — 8	..	..	..	5 14 11
600,070	London United Trams. (1901), 1 to 50,007	10	8 %	6 %	3 %	3 %	6¾ — 7⅛	6⅝ — 7⅛	..	..	..	4 0 0
399,930	Do. do. 60,008 to 100,000	10	8 %	6 %	3 %	3 %	6¾ — 7⅛	6¾ — 7⅛	..	..	..	4 0 0
125,000	Do. do. 5 % Cum. Pref., 1 to 125,000	10	5 %	5 %	5 %	5 %	7⅞ — 8⅛	7⅞ — 8⅛	..	..	..	5 14 8
1,381,000	Do. do. 4 % 1st Mort. Deb. Stock	100	4 %	4 %	4 %	4 %	82 — 86	82 — 86	..	..	..	4 13 0
314,016	Metropolitan Electric Trams., Defd.	1	Nil	Nil	Nil	Nil	⅛— ⅜	⅛— ⅜	..	..	..	Nil
500,000	Do. do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	⅜— ⅝	⅜— ⅝	17/9	16/10½	..	5 2 7
350,000	Do. do. 4½ % Deb. Stock Red.	100	..	4½%	4½%	4½%	94 — 97	94 — 97	..	..	..	4 10 11
245,500	Potteries E. Trc.	1	5 %	5 %	4 %	4 %	⅛— 3/16	⅛— 3/16	..	..	..	7 2 3
245,500	Do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	⅛— ¼	⅛— ¼	..	..	..	6 13 4
245,000	Do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	95 — 98	95 — 98	..	..	..	4 11 10
37,350	Telegraph Construction and Maintenance	12	20 %	15 %	15 %	15 %	30 — 32	30 — 32	..	..	..	5 18 2
150,000£	Do. 4 % Ded. Bds., 1 to 1,500 Red., 1909	100	4 %	4 %	4 %	4 %	99½—102½	99½—102½	..	..	..	3 18 1
599,200	Undergd. E. R., Lon., 5 % Profit Shar. S. Nts.	..	..	5 %	5 %	5 %	46 — 51	44 — 49	..	..	—2	10 4 0
66,666	Willans & Robinson, 1 to 30,000 & 80,001 to 116,666	5	3 %	Nil	Nil	..	1⅛— 1⅜	1⅛— 1⅜	..	..	..	Nil
66,666	Do. 6 % C.P., 30,001 to 80,000 & 125,001 to 141,666	5	6 %	Nil	Nil	..	3¾— 4¼	3¾— 4¼	..	..	..	Nil
246,574	Do. 4 % 1st Mort. Deb. Stock	100	4 %	4 %	4 %	4 %	75 — 80	75 — 80	78	75	..	5 0 0

ELECTRICITY SUPPLY COMPANIES.

14,000	Bromley (Kent) E.L. & P,. 1 to 14,000	5	5 %	5½%	5½%	5½%	4⅜— 5⅛	4⅜— 5⅛	..	..	..	5 7 4
70,000	Do. do. 4½ % 1st. deb. stock	100	4½%	4½%	4½%	4½%	98 —100	98 —100	..	..	..	4 10 0
29,798	Brompton & Kens. Elec. Lt. Sup., Ord., 1 to 20,000	5	10 %	10 %	10 %	10%	7⅞ — 8	7⅞ — 8	..	..	..	6 13 4
10,202	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	7⅞ — 8⅛	7⅞ — 8⅛	..	..	..	4 4 10
336,876	Central Electric Supply 4 % Guar. Deb. Stock	100	4 %	4 %	4 %	4 %	98 —101	98 —101	99	97½	..	3 19 3
80,000	Charing Cross and Strand Electricity Supply	5	8 %	8 %	5 %	5 %	3⅝— 4⅛	3⅝— 4⅛	..	..	..	6 1 3
80,000	Do. do. do. 4½ % Cum. Pref.	5	4½%	4½%	4½%	4½%	3¾— 4	3⅝— 3⅞	..	..	— ⅛	5 16 2
80,000	Do. "City Undertaking" 4½ % Cum. Prf.	5	4½%	4½%	4½%	4½%	3⅝— 3¾	3⅝— 3¾	67/6	..	..	5 16 2
427,400	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	96 — 99	96 — 99	..	..	..	4 0 10
49,436	Chelsea Electricity Supply, Ord.	5	5½%	6 %	6 %	4½%	3½ — 4⅛	3½ — 4⅛	..	..	..	5 5 11
175,000£	Do. do. 4½ % Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	102 —105	102 —105	..	..	..	4 5 9
70,595	City of Londo Elec. Lighting, Ord. 40,001—110,595	10	5 %	6 %	6 %	6 %	8⅞— 9⅛	8⅞— 9⅛	9⅛	..	..	6 3 1
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	6 %	6 %	6 %	10⅞— 11⅛	10⅞— 11⅛	11	..	..	5 4 4
400,000£	Do. 5 % Db. Stk., Scrip. (iss. at 115) all pd.	..	5 %	5 %	5 %	5 %	122 —125	122 —125	..	..	..	4 1 4
800,000	Do. 4½ % 2nd. Db. Stk., Prov. Crts., all pd.	100	4½%	4½%	4½%	4½%	97 —100	97 —100	97½	..	..	4 10 0
40,000	County of Durham Electrical Power, Ord.	5	4 %	£3 7 0	4 %	4 %	3¾— 4⅛	3¾— 4⅛	97/6	..	..	4 14 1
50,000	Do. do. do. 5 % Pref.	5	5 %	5 %	5 %	5 %	4⅛— 4⅜	4⅛— 4⅜	..	..	..	5 2 7
40,000	County of London Electric Lighting, Ord. 1—40,000	10	4 %	4½%	5 %	5 %	6½— 7⅛	6½— 7⅛	..	..	..	6 9 0
40,000	Do. do. 6 % Pref., 40,001—60,000	10	6 %	6 %	6 %	6 %	10 — 11	10⅛— 11⅛	10⅞	10⅜	+ ⅛	5 11 8
400,000£	Do. do. 4½ % Deb. Stock	..	4½%	4½%	4½%	4½%	107 —110	107 —110	..	..	..	4 1 10
400,000	Do. do. 4½ % 2nd. Deb. Stock	Stock	4½%	4½%	4½%	4½%	96 — 99	96 — 99	97½	..	..	4 10 11
80,000	Edmundson's Electric Corporation, Ord. Shares	5	7 %	7 %	4 %	Nil	⅜ — 1	⅜ — 1	..	..	..	11 0 0
80,000	Do. do. 6 % Cum. Pref.	5	6 %	6 %	6 %	3 %	1 — 1⅜	1 — 1⅜	..	..	..	8 11 5
350,000	Do. do. 4½ % 1st Mort. Deb. Stk.	100	4½%	4½%	4½%	4½%	76 — 81	76 — 81	..	..	..	5 11 1
10,000	Folkestone, 1 to 10,000	5	5½%	5½%	5½%	5½%	4⅞— 5⅛	4⅞— 5⅛	..	..	..	5 4 9
10,000	Do. 5 % Cum. Pref., 1 to 10,000	5	..	..	5 %	5 %	4⅞— 5⅛	4⅞— 5⅛	..	..	..	4 13 0
90,000	Do. 4½ % 1st Deb. Stock	100	4½%	4½%	4½%	4½%	96 — 99	96 — 99	..	..	..	4 10 11
13,000	Hove, 1 to 13,000	5	8½%	8½%	9 %	9 %	6½ — 7 xd	6½ — 7 xd	..	..	..	6 8 7
21,000	Kensington and Knightsbridge Electric Ord.	5	12%	12 %	10 %	10 %	8⅞— 9⅛	8⅞— 9⅛	..	..	..	5 8 1
90,000	Do. do. do. 4 % Deben. Stk.	Stock	4 %	4 %	4 %	4 %	94 — 97	95 — 98	..	..	+1	4 1 8
111,000	London Electric Supply Corporation, Limited, Ord.	3	Nil	3 %	4 %	4 %	1⅛— 1⅜	1⅛— 1⅜	..	..	..	6 16 2
70,000	Do, do. do. 6 % Pref.	5	6 %	6 %	6 %	6 %	4⅛— 4⅜	4⅛— 4⅜	..	..	..	6 9 9
874,395	Do. do. 4 % 1st Mort. Deb. Stk. Red.	Stock	4 %	4 %	4 %	4½%	89 — 93	89 — 93	92⅝	90½	..	4 16 9
200,000	Metropolitan Electric Supply, 1 to 100,000	5	8⅜%	10 %	10 %	8 %	5⅛— 5⅜	5⅛— 5⅜	5⅛	5⅛	..	6 19 2
76,121	Do, 4½ % Cum. Pref. 1—71,106	5	4½%	4½%	4½%	4½%	4⅝— 5⅛	4⅝— 5⅛	..	..	..	4 7 10
220,000£	Do. 4½ % 1st Mort. Deben. Stock	..	4½%	4½%	4½%	4½%	103 —107	103 —107	..	..	..	4 10 0
250,000£	Do. 3½ % Mort. Deben. Stock Redem.	Stock	3½%	3½%	3½%	3½%	87 — 92	87 — 92	..	..	..	3 16 1
250,000	Midland Electric Corporation, 4½ % 1st Mort. Deb.	100	4½%	4½%	4½%	4½%	95 — 98	95 — 98	..	..	..	4 11 10
87,500	Newcastle-on-Tyne, 1 to 87,500	5	8 %	8 %	8 %	8 %	6½ — 6⅝	6½ — 6⅝	..	..	..	5 18 6
87,500	Do. 5 % Pref., 1 to 87,500	5	5 %	5 %	5 %	5 %	5 — 5⅛	5 — 5⅛	..	..	..	4 10 11
10,852	Notting Hill Electric Lighting	10	6 %	7 %	7½ %	7½%	11 — 12	11 — 12	..	..	..	6 5 0
20,000	Oxford, 1 to 96 and 407 to 20,310	5	6⅔%	7 %	7 %	7 %	5⅝ — 6	5⅝ — 6	..	..	..	5 16 8
50,000	Do. 4 % Deb. Stock	100	4 %	4 %	4 %	4 %	95 — 97	95 — 97	..	..	..	4 2 6
40,000	St. James' and Pall Mall Electric Light, Ord.	5	14½%	14½%	12½%	10 %	7⅛ — 8⅛	7⅛ — 8⅛	7⅞	7⅝	..	6 1 3
20,000	Do. do. 7 % Pref. 20,001 to 40,000	5	7 %	7 %	7 %	7 %	6 — 7	6 — 7	..	..	..	5 0 0
150,000£	Do. do. 3½ % Deb. Stock Red.	100	3½%	3½%	3 %	3½%	86 — 91	86 — 91	..	..	..	3 16 11
12,000	Smithfield Markets Electric Supply, Ord.	5	4 %	4 %	4 %	Nil	⅛— 1⅛	⅛— 1⅛	..	..	..	Nil
50,000	Do. do. do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %	71 — 75	71 — 75	..	..	..	6 0 0
65,000	South London Electricity Supply, Ord.	5	3 %	4 %	4 %	3 %	1⅞— 2⅛	1⅞— 2⅛	..	..	..	6 6 4
120,000	South Met. Elec. Lt. & Power, Ord.	1	Nil	Nil	2½%	2½%	⅜— ⅝	⅜— ⅝	..	..	..	3 6 8
117,968	Do. do. 7 % Pref.	1	7 %	7 %	7 %	7 %	1⅝— 1⅞	1⅝— 1⅞	22/6	..	..	5 17 11
200,000	Do. do. 4½ % 1st Deb. Stk.	100	4½%	4½%	4½%	4½%	99 —102	99 —102	..	..	..	4 8 3
80,000	Urban Electric Supply, Ord.	5	5 %	5 %	5 %	5 %	1⅞— 2⅛	1⅞— 2⅛	..	..	..	11 10 6
80,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	1⅞— 2⅛	1⅞— 2⅛	..	..	..	8 13 11
200,000	Do. do. 4½ % 1st Mort. Db. Stk. Red.	100	..	4½%	4½%	4½%	92 — 95	92 — 95	..	..	..	4 14 9
110,000	Westminster Electric Supply, Ord.	5	18½%	14 %	13 %	12 %	8½— 9½	8½— 9½	9	8⅝	..	6 9 9
81,279	Do. do. 4½ % Cum. Pref. (Original 5 %—Red. to 4½ % from 31st Dec., 1905)	5	5 %	5 %	5 %	4½%	4½— 5⅛	4½— 5⅛	98/9	..	..	4 5 9

* Unless otherwise stated, all shares are fully paid. † Quotations on Liverpool Stock Exchange.

Bank rate of Discount 4½ per cent., August 15th, 1907.

AUTOMATIC SYNCHRONISING.*

By PAUL MacGAHAN and H. W. YOUNG.

In order satisfactorily to connect an alternating-current generator, rotary converter or synchronous motor to a system which is already in operation, it is necessary that certain conditions be complied with. The fundamental condition is that the electromotive force of the incoming machine and of the system to which it is to be connected shall be approximately alike at each instant. This requires that the two frequencies shall be the same; that the two voltages shall be equal, as measured on a voltmeter; and that the two voltages shall be of the same phase—*i.e.*, that their maximum and zero values are coincident.

The synchroscope is so designed that the voltages of the incoming machine and bus-bars or line circuits act to rotate a pointer over a dial, the angle between the pointer and the vertical being always the phase angle between the two sources of electromotive force to which the device is connected. If the incoming machine is running too fast, the pointer rotates in the direction marked "Fast" upon the dial, and if the incoming machine is slow the pointer moves in the direction marked "Slow" upon the dial. When the frequencies of the incoming and operating machines are the same and the phase relations are identical, the pointer remains stationary in a vertical position at zero.

The inductor type synchroscope (fig. 1) is especially applicable where voltage transformers are already installed for use with other meters. As it requires only about 10 apparent watts it may be used on the same transformers with other meters. There are three stationary coils, and a moving system comprising an iron armature rigidly attached to a shaft, suitably pivoted and mounted in bearings, as shown in fig. 1. A pointer is also attached to the shaft. The moving system is balanced and is not subjected to any restraining force, such as a spring or gravity control. A rotation of the armature indicates a difference in frequency, and the rate and direction of rotation show which current has the higher frequency and the amount of the difference.

The Lincoln type (fig. 2) consists of an alternating-current bipolar motor with a laminated iron field and core, on which is wound a distributed two-phase winding connected in "split-phase"

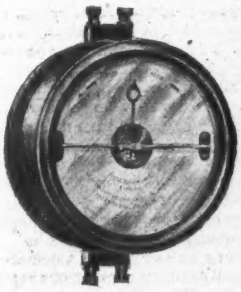


Fig. 1.—Inductor Type Synchroscope.

Fig. 2.—"Lincoln" Type Synchroscope.

relation through a non-inductive resistance and an inductive resistance. The former consisting of two stationary illuminating lamps, behind the letters F and S on the glass dial, and the movable lamp attached to the indicating pointer. On the magnet are wound two field coils.

In addition to the openings in the dial in the form of the letters F and S, there is between them a narrow opening lighted up by the internal lamps, which marks the position that the pointer should have at the moment of synchronising, as shown in fig. 2.

As the synchroscope cannot follow the differential frequency when synchronising is begun with a great difference in speed of the generators, synchronising lamps should be used until the speed is correct within approximately 10 per cent., when the synchroscope will fall into step and indicate by the direction of its rotation the speed relation between the incoming machine and the bus-bars.

The automatic synchroniser, fig. 3, is primarily intended for use in stations operating large capacity machines and where it is essential that synchronising be done rapidly and safely.

A successful automatic synchroniser should close the circuit when all of the conditions are suitable for closing, and it should prevent the closing of the circuit until these conditions are reached. This involves the following:—

1. It should permit the coupling of the machines as soon as the difference in speeds is within safe limits, and it should prevent the coupling of the machines at other times.

2. It should permit the coupling of the machines when the electromotive forces are within proper limits, and should prevent the coupling when the electromotive forces are too widely divergent.

3. It should permit the coupling of the machines when the phase difference is within permissible limits, and should prevent the coupling when it exceeds these limits.

4. It should close the relay circuit for coupling the machines on the first occasion when the three foregoing conditions simultaneously occur.

5. It should close the relay contacts in advance of the period for coupling, by a sufficient interval to allow the switch to act at the exact moment of synchronism. The greater the difference in speed the greater should be this advance in angle in order that the time allowed may be constant. As different types of switches require different amounts of time to close, the time of advance should be adjustable.

6. It should be certain and safe in its operation, and if anything in the mechanism fails it should prevent coupling.

The automatic synchroniser is especially well adapted for use in power stations of large railway systems. When accidents occur which entirely shut down one or more sub-stations, it is exceedingly important to be able to start up with the least possible delay. With alternating-current starting motors and an automatic synchroniser for each rotary converter this can be done very quickly. Unless the voltage of the system has been greatly disturbed it is simply necessary to close the starting motor switches and the automatic synchroniser will do the rest.

The working parts of an automatic synchroniser are shown in fig. 4, page 746, to which the following index applies:—

A—Sliding platinum-tipped contact attached to and actuated by the pivoted beam E.

B—Insulating segment secured to a sleeve loosely fitting pivoted shaft L and by means of pin B′ actuated by pivoted levers J and G, the two latter being connected by a light connecting rod I.

B′—Pin secured to B and located between prongs of arm J.

C—Platinum-tipped contact secured to segment B.

D—Pivoted platinum-tipped contact controlled by spring D′ and normally bearing on contact C.

E—Pivoted beam for suspending solenoid cores, actuating contact A and dash-pot shell F pivotally attached to E.

F—Shell of dash-pot pivotally attached to E.

F′—Piston of dash-pot attached to pivoted arm G.

G—Pivoted arm normally held in position by control spring H.

H—Control spring holding F′, G, I, J and B in normal position.

I—Connection rod transmitting motion of F′ and G to J.

J—Two-pronged arm on shaft L, the right prong being normally held by means of spring K against the small pin B′ screwed into segment B.

K—Light controlling spring for J, the inner convolution being secured to J and the outer convolution secured to pin B′.

L—Pivoted shaft carrying segment B and forming bearing for J. This shaft is in same plane as bearing for E.

M—Pin on segment B, so arranged that it can engage projection on D, thus lifting it from its normal position on contact C.

N—Adjustable control weight for varying movement speed of segment B.

The dash-pot shell F is provided at its top with a valve which opens on the downward stroke, thus allowing control spring H to instantly pull piston F′ toward its initial position.

Each solenoid is wound in eight sections, alternate sections being connected in series, thus forming two circuits in each; one circuit of each solenoid being connected in series with a circuit of the other. This forms two independent circuits in the instrument, each circuit having half its turns on each solenoid, as shown in fig. 5, page 746.

With the incoming machine in phase with the running machine or in synchronism, the magnetic fields induced by the currents in the left hand solenoid oppose each other, thus neutralising the pull on its iron core, and at the same instant the magnetic fields induced by the currents in the right hand solenoid assist each other, thus giving a maximum pull on its iron core and drawing it to the bottom of the solenoid.

When the incoming machine is not in synchronism, the magnetic fields induced by the currents in the left hand solenoid assist each other, thus exerting a maximum pull on its iron core, and drawing it to the bottom of the solenoid. At the same instant the magnetic fields due to the currents in the right hand solenoid oppose each other, thus neutralising the pull on its iron core. When the incoming and running machines are in 90° phase relation, the solenoids exert equal pulls on their iron cores, which take up positions at equal distances from the bottom of each solenoid.

The displacement of the beam from the synchronising position (due to differences in phase between the machines) imparts to it a

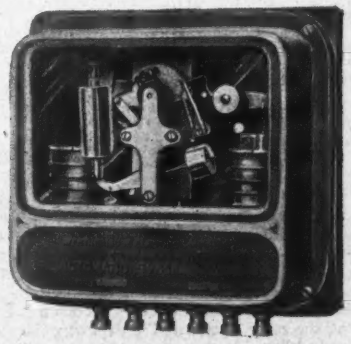


Fig. 3.—Automatic Synchroniser.

* The *Electric Journal*. (Abstract.)

walking-beam action, and this movement up and down corresponds to the dark or light period of lamps or to the pointer rotation of the regular dial synchroscope. Suppose:—

1. That the incoming machine is almost in step and phase, *i.e.*, synchronism with the running machine. It will be found that as it approaches synchronism, the right hand solenoid of the synchroniser will slowly pull its core down, thus raising the left end of beam E. The raising of E will lift the dash-pot shell F so slowly that the air escapes with sufficient freedom so that the piston F′ is not effected and is held at its normal position by the control spring H. With the position of the piston F′ undisturbed, the elements G, I, J and B will remain stationary so that the contact C may for the moment be regarded as fixed in position. The solenoid

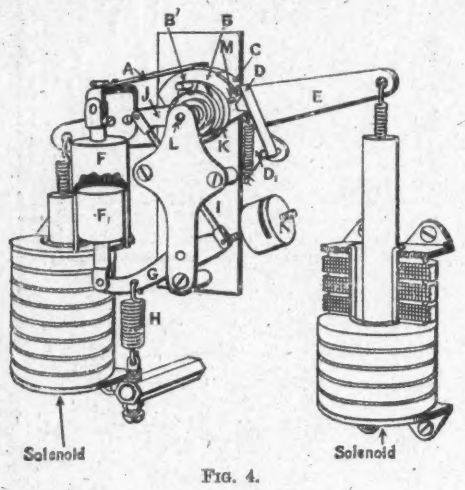


FIG. 4.

core will continue to travel slowly down, until at exact synchronism it reaches the bottom of the solenoid and this movement will have caused contact A to move forward and touch contact C, which already being in contact with D will complete the relay circuit through the contacts A, C and D, as shown in fig. 5. The completion of this circuit will draw up the relay armature core, thus switching in the solenoid that closes the main circuit-breaker and switches in the generator.

2. That the difference in speed between incoming and running machines is somewhat greater than in the first case. It may be seen that the air in the dash-pot will not have sufficient time to escape and piston F′ will be drawn upward, thus advancing contact C towards contact A. This movement will allow C to make contact a little sooner than in the first case, thus energising the relay and closing the coil of the main switch a sufficient time ahead of

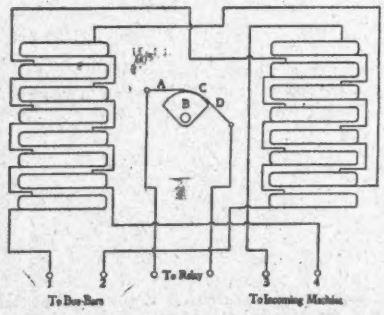


FIG. 5.

synchronism to allow the switch the necessary amount of time to overcome its lag element, thus closing just at or just before the time of exact synchronism, rather than just behind this point.

3. That the difference in speed between running and incoming machines is exceeded for safe synchronising. The piston F′ will (by suction of F) be rapidly drawn far enough to advance C a sufficient amount to enable the pin M on segment B to lift up contact D, thus opening the relay circuit and preventing the closing of the main switch or breaker. It may be seen that the greater the speed difference between machines the greater the advance C will make toward A, owing to the fact that less air has time to escape from the dash-pot and the piston will, therefore, force B further round. This condition will continue until the frequencies again approach within safe limits, when the action explained under the first and second cases will take place.

If the voltage of the incoming machine differs considerably from that of the bus-bars to which it is to be connected, the device will not close the contact, since the effect of the excessive voltage on the left-hand solenoid is to hold that end of the beam too low at the moment of synchronism. Thus the incoming machine will not be connected in parallel unless the voltages are approximately equal, the machine in phase with the line and the frequency correct.

An auxiliary relay is used to avoid carrying the current of the main switch closing coil through the contacts of the automatic synchroniser. This relay consists of a simple solenoid having a core so located as to be drawn up and bridge two contacts in the circuit of the closing coil.

A controlling switch, such as used with oil circuit-breakers, is interposed in circuit with the synchroniser and electrically-operated switch. By means of this control switch the main or electrically-operated switch, or oil circuit-breaker, may be tripped, but cannot be closed, as the closing coil is normally out of circuit until the synchroniser completes the contact.

The control switch is of drum construction, and when turned to the "trip" position the circuit through the trip coils of the main switch is completed, thus opening the connection from the machine to the bus-bars. At the same time, current at approximately 100 volts from the alternating current bus-bars is fed to the left hand pair of binding posts of the synchroniser, which brings the rocker arm from the synchronous position to the horizontal position, thus opening the synchroniser contacts and leaving them in a safe position.

On turning the control switch to the closed position, approximately 100 volts alternating current from both the bus-bars and the incoming machine is connected to the synchroniser and the rocker arm begins to oscillate rapidly. Immediately, the closing circuit is completed as far as the auxiliary relay, and the direct current which operates the relay is closed as far as the synchroniser. When the synchroniser closes its contacts the relay also closes and operates the main switch. On returning to "off" position after closing the main switch the controller opens the direct-current circuits to the synchroniser and to the closing coil of the main switch, this latter circuit being opened in a second place by the relay. An instant later the transformers are disconnected from the synchroniser.

DRAFT HOME OFFICE REGULATIONS.

Factory and Workshops Act, 1901.

We have received from Mr. H. Faraday Proctor, Hon. Secretary, the following schedule of objections raised by the Incorporated Municipal Electrical Association to the draft regulations recently issued from the Home Office:—

The objectors submit that "Undertakers," with statutory powers and obligations authorised under the Electric Lighting Act, should be under the control and regulations of one Government Department only as regards technical matters.

Since, by the Electric Lighting Acts, undertakers are already and always have been subject to the control and regulations of the Board of Trade, as made and amended from time to time, and since such regulations provide ample protection to workmen, different regulations issued by another Department are undesirable. If further or more detailed regulations are necessary, the Association would welcome an amplification of the existing regulations rather than the issue of new rules by any other Department. The Association therefore asks:—

That nothing contained in the regulations as drafted or as they may be amended shall apply to undertakers, or their works, authorised under the Electric Lighting Acts.

The Association submits that the regulations generally would unfairly and seriously handicap the use of electricity as compared with other forms of energy not subject to such regulations.

The Association submits that the regulations should not be made retrospective, except in cases where it is shown that existing works have in practice proved dangerous.

The Association submits that the regulations as a whole are too vague and general to be instructive or useful, whilst even in the hands of an expert they are open to so many constructions as to be a source of perpetual misunderstanding and expense.

All inspectors employed in connection with the enforcing of the regulations should be specially appointed electric inspectors, fully qualified and experienced in the description of works under inspection.

Occupiers of premises should in all cases be given a right of appeal against the decision of any inspector.

Preliminary.—If the regulations are in any instances made retrospective, an alteration of the dates by which the regulations shall be complied with is necessary, as compliance with the dates mentioned would be impracticable.

Definitions.

Cables.—The Association respectfully submits that this definition is improperly applied to the expression "cable," and would lead to great confusion.

Switchboard.—The Association submits that this definition is too wide. If taken literally a single switch, a single fuse or the coils of an arc lamp with the requisite conductors would constitute a switchboard.

Switchboard Passage-Way.—This definition is too general. As it stands it would embrace even a telephone box containing a switch for controlling the light, &c.

Regulation 1.—The Association submits that the word "are"

should be substituted for the word "may" in the second line. The Association is of opinion that this in common with most other of the regulations is too vague and general to be of any real use. Regulations drawn up on such general lines are deemed very undesirable, since they give to Inspectors the power of deciding what shall or shall not be considered necessary.

It is not proposed to repeat these remarks in respect of each rule to which they apply; it will be understood that they apply generally to nearly every one of the regulations as drafted.

Regulations 2, 3, &c.—See objection to No. 1.

Regulation 4.—This regulation should be deleted. The use of switch-fuses and disconnecting links should most certainly be allowed. Note.—Under Regulation 9 a link would appear to be a switch.

Regulation 5.—The last sentence commencing with the words "Every fuse shall be" should be deleted or amended. The Association is of opinion that there are certain fuses which must of necessity receive attention, whilst there is to a certain extent a risk of shock, but such would be attended to by competent persons only, and, therefore, the danger would be reduced to a minimum, and would be trivial in character.

Regulation 11.—This regulation should be deleted, because (*a*) it is preferable and far safer that under certain conditions there should be one switch only for the control of two or more motors, &c. Conditions often exist under which switches, if more than one be installed, are liable to be mistaken one for another with dangerous results, as, for instance, on a crane or other machine driven by more than one motor; (*b*) the use of switch-fuses, instead of switches, should be allowed, as the addition of innumerable switches would greatly add to the risks as well as expense.

Regulation 12.—The Association is of opinion that paragraphs 2 and 3 should be deleted, because they would involve great expense without corresponding benefits.

Regulation 13.—Paragraph 2 should be deleted. Because (*a*) the grouping of portable apparatus on one control should be allowed. (*b*) the provision of a plug connector is sufficient in most cases, and is often preferable to a switch.

Regulation 15.—This regulation should be made to apply to high-pressure and extra-high-pressure switchboards only.

Regulation 17.—As previously stated, it is imperative that these regulations should not be made retrospective; this observation applies especially to this regulation. This regulation cannot be enforced, even as regards new work, unless the definitions are amended.

Regulation 18.—Sub-section (*b*).—This sub-section should not apply to low-pressure instruments (where one pole is at earth potential) used on switchboards for the control of high-pressure or extra-high-pressure circuits.

Sub-section (*d*).—This sub-section should be deleted, as compliance is impracticable, or so nearly so, as to be most undesirable.

Regulations 21 to 33 (inclusive).—These regulations should only apply to high-pressure and extra-high-pressure working.

Regulation 30.—Although referred to in the above paragraph, special attention is directed to this regulation, which, it is contended, would needlessly alarm the great majority of users of electricity who use low-pressure currents, and would result in a serious set-back to the electrical industry generally. The Association submits that this regulation should only apply where high-pressure or extra-high-pressure is employed.

Regulation 33.—Line 3.—The words "switchboard or" to be deleted, as, owing to the wording of the definition of a "switchboard," a switch for controlling the lighting of the sub-station could not be placed within reach, and such arrangement is necessary.

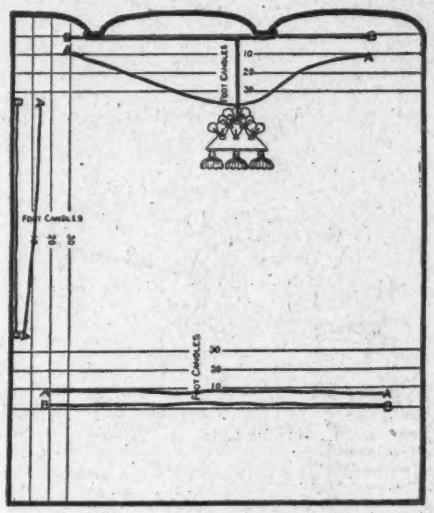
Line 4.—The word "accidental" to be inserted between the words "within" and "reach."

THE INEFFICIENCY OF DIFFUSED LIGHTING SYSTEMS.

The Convention of the Illuminating Engineering Society of America this year has been particularly rich in suggestive papers on the science of electric lighting. One of these, by Preston S. Millar (published in the *Western Electrician*), on the elements of inefficiency in diffused lighting systems, was especially useful. Diffused lighting was specified as that form of artificial lighting in which the ceiling and walls constitute the reflecting and diffusing media by which the light is transmitted to the plane whose illumination forms the first object of the installation. Direct lighting includes the numerous methods in which the lighting of the ceiling and walls is incidental, as the bulk of the light is thrown directly where it is required.

Diffused lighting is generally characterised by a reduced intrinsic brilliancy of light sources and by uniform distribution of illumination. This is said to be less fatiguing and more pleasing to the eye than direct lighting effects, and to secure these advantages efficiency is freely sacrificed, the extent of the sacrifice depending on the nature of the installation. The loss is comparatively small where the object illuminated is the ceiling or wall, and large for utilitarian purposes—such as desk lighting. The first element of inefficiency is the loss of a large proportion of light in multiple diffused reflection, which is an integral part of this system of lighting.

A temporary equipment was fitted up for the purpose of testing the effect of both direct and diffused lighting, the illustration showing the type of lighting fixture used, and the vertical section of the room. Superimposed upon this vertical section are found illumination curves in foot-candles plotted from tests of the horizontal illumination of the working plane, the vertical illumination of the wall, and the horizontal illumination with the plane inverted



Illumination Tests.

on the ceiling. The tests were made at points about midway between one end of the room and the lighting fixture. A sufficient number of lamps were burned in each installation to afford satisfactory illumination for reading. One set of curves shows the illumination due to diffused lighting, the other set giving the illumination due to direct lighting.

Tests were made to determine the intensity and efficiency of illumination on a horizontal plane 30 in. above the floor, the figures working out as follows:—

TABLE I.—Temporary Installation at Electrical Testing Laboratories.

	Direct.	Diffused.
Square feet of floor space	176	176
Number of lamps	4	24
Type of lamp	All oval anchored filament incandescent electric.	
Average mean horizontal candle-power ...	10·2	19·4
Average watts per mean horizontal candle-power	3·53	5·16
Total watts	145	2,398
Horizontal illumination, average foot-candles	1·02	3·29
Foot-candles per watt per square foot ...	1·24	0·24
Relative effect of installation as a whole $\left\{\frac{\text{Diffused}}{\text{Direct}}\right\}$ ...	19 per cent.	

Now the two prime elements upon which the lighting efficiency depends are, first, the efficiency of the illuminants measured in lumens per watt, and secondly, the efficiency with which the light is utilised, that is to say, the proportion of the total flux of light which is effected on the plane considered. It should be borne in mind that there are three expressions in efficiency, (*a*) efficiency of illuminants in lumens per watt, (*b*) efficiency of light utilised, which is the ratio of lumens applied to lumens generated, and (*c*) efficiency of lighting installation as a whole measured in foot-candles per watt per square foot, or lumens applied per watt. If the average intensity of illumination is determined on the test plane, the lumens applied are found by multiplying this average intensity by the area investigated, expressing the intensity in foot-candles and the area in square feet. Such calculations have been worked out in connection with the installation mentioned in Table I, and compared with figures obtained at the Harlem office of the New York Edison Co., with the following results:—

TABLE II.

—	Temporary installation at Electrical Testing Laboratories.		Harlem office of New York Edison Co.	
	Direct.	Diffused.	Direct.	Diffused.
Total flux of light, lumens ...	424	4,824	13,938	30,532
Flux on working plane, lumens	180	579	6,642	4,689
Efficiency of light utilisation	42·3%	12·0%	47·7%	15·4%
Efficiency of illuminants, (lumens per watt) ...	2·92	2·01	3·34	3·34
Relative effect of systems; $\frac{\text{Diffused}}{\text{Direct}}$	28 per cent.		32 per cent.	
Sacrificed to secure diffusion	72 per cent.		68 per cent.	

If the horizontal plane only is considered, the inefficiency of the diffused lighting system in the Electrical Testing Laboratory's installation is only 28 per cent. over that of the direct-lighting system, this figure being independent of the efficiency of the lamps, and being the correct basis of comparison. The loss of light in the two diffused lighting systems considered, amounted to about 70 per cent., and that was due to multiple diffused reflection.

Another feature of inefficiency is that it is necessary to provide everywhere in the area considered an illumination which must be approximately the highest intensity required at any point lighted by the installation due to uniform distribution, whereas with light which may be subject to effective control, the highest intensity is produced at a point where the maximum is required, and at points where the high intensity is neither required nor desirable, the lighting intensity is allowed to approach the minimum, thus obtaining considerable economy. Moreover, in diffused lighting, the person himself and closely adjacent objects obstruct a considerable proportion of the light which would otherwise be effective. Yet another matter of inefficiency is the ineffectiveness of light rays falling at small inclinations on the surface to be illuminated.

The fourth factor is a physiological one depending on the craving of the eye for higher intensities upon the surface upon which it is directed when surrounding objects are brilliantly lighted. This has been decided by bringing at different times various individuals into the test room, each person being asked to seat himself in any position which would give him the greatest ease and comfort in reading a sheet of white newspaper. He was asked to hold the newspaper at an angle which seemed to him to give the best results. The test plate of the illumination photometer was then placed immediately beneath the paper, and parallel to it in such a way that the paper could be removed and the intensity of the illumination which was thrown upon it could be measured without changing any other conditions, the reader remaining seated.

It should be mentioned that while the reader's position was being selected, the illumination was kept at a low intensity. With the direct lighting system, the illumination was then raised and manipulated until the intensity suited to the individual's taste was reached, the paper then being removed and the intensity measured. Immediately after this the illumination was again reduced to the low limit, and after a short interval the diffused lighting system was tried, other conditions remaining the same. This, in its turn, was varied until the required intensity had been produced and measured.

Taking the average of 10 observers, it was found that 65 per cent. higher intensity of illumination was required for reading with the diffused lighting system than was necessary with the direct lighting system. The following table gives one or two interesting points with regard to this test:—

TABLE III.

	Direct lighting.	Diffused lighting.
Average intensity	2·73	4·45
Average difference from mean, amount ...	·46	·99
Average difference from mean, per cent. ...	17	22
Maximum variation above mean, per cent. ...	37	42
Maximum variation below mean, per cent. ...	31·5	42
Variation, highest above lowest, per cent. ...	100	142

In the case of a placard viewed at a distance of 8 ft. or 10 ft., 30 times as much light was required to allow the observer to read as well with diffused lighting as with the direct lighting arrangement. This was due to the fact that large portions of the wall were within the angle of vision, and exercised a powerful influence upon the eye. The walls were relatively dark in the direct lighting system, and brilliantly illuminated with the diffused lighting system; the pupil of the eye in the latter case considerably contracted.

The general conclusions drawn by Mr. Millar were as follows:—In diffused lighting systems of the type considered where the illumination of a working plane is one of the prime objects, a large proportion of the light is lost, and that which is not lost becomes less effective. Brilliant illumination is produced where it is useless and even undesirable, and conditions are established which create a demand for an unduly high intensity of illumination on the object viewed. This applies to any system of diffused lighting involving the loss of a large proportion of light, such as cove lighting, lighting with skylight effects, tube lighting, &c. Lighting with large sources is more liable to these effects than lighting with small sources.

The practical outcome of the tests appears to be that the illuminating engineer can often meet the outcry for more light by reducing the intensity of illumination on unimportant objects which are unduly well lit; as much care should be taken to secure suitable minimum intensities as is generally expended in striving for maximum values. By taking advantage of opportunities to reduce intensity at unimportant places, not only is efficiency gained, but as a general rule, better lighting is also effected.

Continental Trade Slackening.—According to a statement published by the *Bohemia* of Prague, the Allgemeine Elektrizitats Gesellschaft, of Berlin, has addressed a confidential circular to its representatives drawing attention to the fact that the company is again in a position to accept orders for delivery within a fixed period.

PROCEEDINGS OF INSTITUTIONS.

Note on a Series-Parallel Lamp Resistance.

Communicated to the FARADAY SOCIETY by N. T. M. WILSMORE, M.Sc.

THE accompanying diagrams represent a method of arranging lamp resistances, which has been found very convenient for electro-chemical work. The arrangement was devised some years ago by Prof. J. D. Cormack, of University College, London; but, as no account of it has been published by him, and as it does not seem to be generally known, Prof. Cormack has very kindly allowed this note to be read before the Faraday Society.

In the figures only three lamps with their connections are shown, but the number of lamps may be increased indefinitely. The lamp sockets L_1, L_2, L_3, &c., are connected permanently in series with each other and with the terminal T_1; but, by means of the two-way switches, S_1, S_2, S_3, &c., they may be connected up further in several

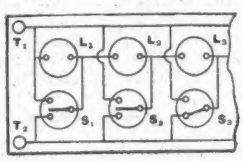


FIG. 1.

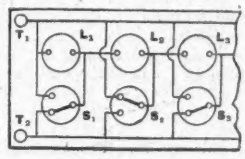


FIG. 2.

different ways, so as to produce a wide variation in the total resistance between the terminals T_1 and T_2. Thus, with three lamps of the same size, the following six combinations are possible: three lamps in series (fig. 1), two lamps in series, one lamp, one lamp in parallel with the other two in series, two in parallel, or three in parallel (fig. 2). If the lamps have a resistance of 100 ohms each, the resistances corresponding to the above steps will be respectively 300, 200, 100, 66·6, 50, and 33·3 ohms. With lamps of different sizes, or with a larger number of lamps, the number of possible combinations becomes much greater. A further advantage of the system is that no movement of the switches can cause a short circuit between T_1 and T_2.

The two-way switches must have a well-defined central "off" position. For this reason, and also because one can follow the connections from the positions of the knobs, Lundberg's "Duplex" tumbler switches have been found suitable.

On the Indicated Horse-Power and Mechanical Efficiency of the Gas Engine.

By PROF. BERTRAM HOPKINSON.

(Abstract of paper read before the INSTITUTION OF MECHANICAL ENGINEERS, *October 18th*, 1907.)

IT has been stated that the indicator diagrams obtained from gas engines do not give as accurate results as those from steam engines, owing to the effects of inertia and back-lash, and that the mean I.H.P. determined from the diagrams taken in a trial may differ considerably from the real mean power. In tests made by the Committee of the Institution of Civil Engineers on the Efficiency of Internal Combustion Engines, the mechanical efficiency taken as the ratio of brake to indicated horse-power varied from 80 to 94 per cent. in three engines of similar type; the results were obviously incorrect, and the ratio of the full-load B.H.P. to the (full-load B.H.P. + light-load I.H.P.) was taken as the mechanical efficiency, when the ratios varied only from 0·86 to 0·888, increasing with the size of engine. The Committee's report throws doubt upon many of the efficiency tests on gas engines that have been published, and even the method above mentioned is questioned by the author, as the friction losses may vary widely with the temperature of the cylinder. The author has carried out a series of experiments on the subject, which have led to the conclusion that if precautions are taken to keep the pressure of the gas supply constant, the diagrams given by the engine are remarkably regular, and whether the engine be missing ignitions or not, it is possible, by the use of a sufficiently accurate indicator, to obtain the indicated power from diagrams within 1 or 2 per cent. Further, the difference between I.H.P. and B.H.P. is rather less than the H.P. at no load under the same conditions of lubrication, mainly because of the difference in the power absorbed in pumping. In the particular engine tested by the author the error from this cause in obtaining the indicated power would amount to about 5 per cent. The friction is substantially constant from no load to full load, provided that the temperature of the cylinder walls is kept the same, but the influence of temperature is very great.

A Crossley engine of 40 H.P. was used, with cylinder 11½ in. diameter by 21 in. stroke, the speed being 180 R.P.M. and the compression pressure 175 lb. per sq. in. abs.; hit-and-miss governing was employed, with magneto ignition, and coal gas was used.

To measure the gas consumption, a gas-holder of 10 cb. ft. capacity was placed in the main near the engine; with this it was possible to determine the volume of gas consumed during, say, 50 suctions, with an accuracy of 1 part in 500, and certainly the

error did not exceed one-half per cent. At the same time the indicator diagrams were photographed. The holder could be filled again without stopping the engine, and assuming the rate of consumption to remain constant while the holder is filling, it is obvious that this method is applicable also to long-continued runs, with accuracy much greater than that of any meter. The holder should be large enough to run the engine for about one minute.

It was necessary to construct an indicator that could be absolutely depended upon within 2 per cent., and that could work for long periods without failure. No form of pencil indicator could fulfil the first of these conditions; the explosion pressure rises to 500 or 600 lb. per sq. in. in less than $\frac{1}{100}$ second, and as the natural period of vibration of an ordinary Richards indicator is of the same order, violent oscillations are set up. Back-lash also of $\frac{1}{100}$ in. at the pencil may cause an error in the area of the diagram of 3 per cent., and as this defect is usually quite $\frac{1}{100}$ in., the error is 6 per cent. The pencil motion is not rigidly parallel with that of the piston, even in the Crosby indicator, and this, again, introduces an error, reducing the apparent value of the mean pressure. With these and other errors, "gas engine diagrams taken with a pencil indicator cannot be relied upon as accurate to within 5 per cent., and the error must often be more like 10 per cent." Wear and tear quickly slackens the joints, so that the life of a pencil indicator when used on a gas engine is limited to a few hundred explosions.

The author designed a new type of indicator, in which the spring consists of a straight steel strip, deflected by a piston, and tilting a mirror; at the same time the apparatus is rotated in proportion to the motion of the engine piston, and the diagram is observed by optical means. There is no lost motion in this instrument; the deflection of the spring is accurately proportional to the pressure, so that the diagrams can be integrated with a planimeter, and the natural period of vibration is about $\frac{1}{700}$ second. The indicator is easily calibrated with dead weights, and can be left open to the engine for considerable periods without attention.

The diagrams were photographed, but they can also be observed directly on a transparent screen and plotted on squared paper, the result being then correct within 5 per cent. Check tests of similar diagrams integrated by separate observers gave a mean area of 0·954, the extremes being 0·963 and 0·940.

In a continuous series of 100 explosions the area does not vary more than 1 per cent. on either side of the mean value, though after a cut-out the next diagram sometimes shows a slight enlargement of the area.

The gas taken per suction with a hit-and-miss governor is determined by the temperature of the cylinder walls and piston, and the opening of the gas-cock; the mean pressure in the cylinder during the suction stroke is about 2 lb. per sq. in. below atmosphere, or 55 in. of water, so that a variation of 2 or 3 in. of water in the pressure of the gas supply may cause a substantial change in the charge. By quickly varying the temperature of the cylinder walls by means of the jacket-water, the gas consumption was made to vary between limits differing by 12 per cent.

During one of the tests made to determine the mechanical losses in the engine, the latter was run with fairly full load, missing about one explosion in five cycles. While careful observations were taken of the brake load (the difference between a dead weight and a spring balance) three photographs of indicator diagrams were taken, each photograph covering about a dozen explosions. At the same time the misses occurring in about a couple of hundred cycles were counted, so that the ratio of missed ignitions to cycles was accurately known. These observations gave all the data for the mechanical efficiency, no observation of speed being necessary; the speed was, however, kept approximately constant by the governor at 180 R.P.M., and in what follows brake power and indicated power are both calculated on the assumption that that was, in fact, the speed of the engine. The following are the results of measuring the three photographs, together with the observations taken at the same time as the photographs:—

TABLE I.

Jacket; Exit temperature.	Explosions Cycles.	M.E.P. from diagram.	Gas per suction.	I.H.P.	B.H.P.
150° F. (65° C.)	0·804	100·3	0·1196	39·7	34·0
—	0·82	99·4	0·1182	40·2	34·6
160° F. (71° C.)	0·825	99·0	0·1164	40·2	34·9

It will be seen that the mean pressures from the three diagrams show very good agreement, being all within 1 per cent. of the mean value after allowing for the small change in gas charge. The mean of the three observations of brake horse-power is 34·5. The mean indicated power is 40·0, giving a mechanical efficiency of 86·2 per cent. The difference between brake and indicated horse-power ranges from 5·7 to 5·3 H.P., the mean being 5·5 H.P. In the course of the test the jacket temperature rose slightly, and this is sufficient to account for the small diminution in mechanical losses observed in the course of the test.

Immediately after the completion of the above full-load tests the brakes were taken off and the engine run without load, the jacket water being throttled so as to prevent the engine from cooling down rapidly. Photographs were at once taken of the indicator diagram, the gas consumption was measured and the ratio of explosions to total cycles was ascertained to be 0·141. The mean pressure was found to be 105·5 lb. per sq. in., the gas consumption 0·1252, giving I.H.P. 7·35, or about 1·85 H.P. more than the difference between the I.H.P. and the B.H.P. in the full-load tests. Had the engine in the latter case been firing every time instead of four times out of five, this difference would have been increased in the ratio $\frac{4}{5}$, becoming 2·3 H.P.

This result, that is, that the power taken to turn the engine round at light load is rather over 2 H.P. more than the mechanical losses at full load, which was verified on many occasions, is due almost wholly to the difference in power absorbed by the pumping strokes of the engine at light load and at full load.

An independent estimate of the power lost in pumping was made by belting the engine to the dynamo and motoring it round without allowing it to take gas. The mean was 3·45 H.P. against 3·5 H.P. estimated from indicator diagrams.

In comparing the mechanical loss with the light load indicated power, care was taken that the conditions of the engine as regards lubrication and cylinder temperature were as nearly as possible the same. It was found that these factors made a very great difference to the engine friction, and it is important to allow for this in basing any estimate of indicated power upon the power absorbed by the engine at light load. At the end of a full-load test the jacket temperature was 179° F. (81° C.), the engine was absorbing about 7 H.P., exploding once in seven cycles, and the ordinary normal lubrication was going on. The gas consumption was 0·1159 cb. ft. per suction. With the engine running under these conditions, the jacket-water, which had previously been shut off, was turned fully on, so that in a few minutes the jacket temperature had fallen to 61° F. (16° C.). The gas consumption was then found to have risen to 0·1205 cb. ft. per suction, or by about 3 per cent., and the engine was taking gas once in 4·85 cycles. Thus the power absorbed had increased, in consequence of the reduced cylinder temperature, to 10·0, or by about 40 per cent. on its value with the hot cylinder. A considerable quantity of water was then injected into the cylinder. The result of this was an immediate drop in the power absorbed to about 6 H.P., or rather less than the engine was using with the hot jacket and with the normal lubrication. This very great variation in the power absorbed by the engine in friction must, of course, be within the experience of many people who have worked practically with gas engines, and it is referred to here mainly because it is so important a factor in the testing of these engines for mechanical efficiency. In the full-load test immediately preceding this experiment the brake-power was 36·2, and if the indicated power had been calculated by adding to the brake power the horse-power absorbed at no load, the result might have been anywhere between 43·2 and 46·2 according as the light-load tests were done with a cold or with a hot jacket. The I.H.P. was determined by measurement of the diagram to be in fact 41·2.

Confirmation of the great variation of power absorbed with the condition of the cylinder was obtained by motoring the engine round.

The power required to drive the engine round with the piston removed was found to be 1·4 H.P. This includes the main bearing friction, valve-lifting and belt losses. The piston friction varied according to conditions between 1·3 and 5·1 H.P., the normal value with jacket at 180° F. being about 2·5 H.P.

In normal working at nearly full load (41·0 I.H.P.) with the jacket at 180° F., the mechanical losses in this engine may be allocated as follows:—

TABLE II.

Suction	1·4 H.P.	3·4% of I.H.P.
Piston friction	2·5 H.P.	6·1% of I.H.P.
Other friction (valve lifting, &c.) ...	1·1 H.P.	2·7% of I.H.P.
Total	5·0 H.P.	12·2% of I.H.P.

The apportionment between piston friction and other friction is somewhat uncertain, as it may be to some extent affected by the existence of pressures in the cylinder; the estimate of piston friction being based upon running the engine with the cylinder open to the air.

The effect of using water as a lubricant when the cylinder is cold is, of course, easy to understand, though the author hardly expected to find that it was so great in amount. It is not quite so marked, though still quite perceptible, when the engine is running fully loaded. In one test, in which the engine was fully loaded and the jacket-water at a temperature of about 180° F. (82° C.) at exit, it was found that injection of water in considerable quantity diminished the number of explosions per minute by about 3 per cent., with the same brake load and speed. This difference is due entirely to the change of lubrication, the water having no effect whatever upon the indicator diagram.

The following is a summary of the various efficiency figures relating to this engine:—

TABLE III.

Thermal efficiency...	33½% to 37%, according to strength of mixture.*
Mechanical efficiency for medium charge.	85% to 90%, according to jacket temperature.
Air-cycle efficiency	52·2%.
Efficiency relative to air cycle ...	0·64 to 0·71.

* The weaker mixtures give the higher efficiency.

A series of tests for mechanical efficiency were made upon a Daimler four-cylinder petrol motor running up to 1,200 R.P.M., having cylinders 3·56 in. diameter with a stroke of 5·11 in.

The mechanical efficiency of this engine is remarkably high for its size. With boiling jacket-water the mechanical efficiency is 90 per cent. at a speed of 400 R.P.M. It falls off to 75 per cent. at a speed

of about 1,300 R.P.M. The thermal efficiency is also high, reaching over 26 per cent. under the most favourable conditions. The air-cycle efficiency corresponding to the compression ratio 3·85 is 41·5 per cent., so that the relative efficiency is 0·625.

APPENDIX.

Description of Indicator.

Fig. 1 is a drawing of the instrument, partly in section. The block A is screwed into the ordinary indicator hole of the engine. The frame B fits over the block, sufficient clearance being left to provide for unequal expansion. The frame is held up by a spring into engagement with the lower face of the nut C (screwed to the top of A), a ball-race being interposed so as to admit of easy rotation of the frame about the axis of A.

The spring D is a piece of steel strip resting in grooves at the end

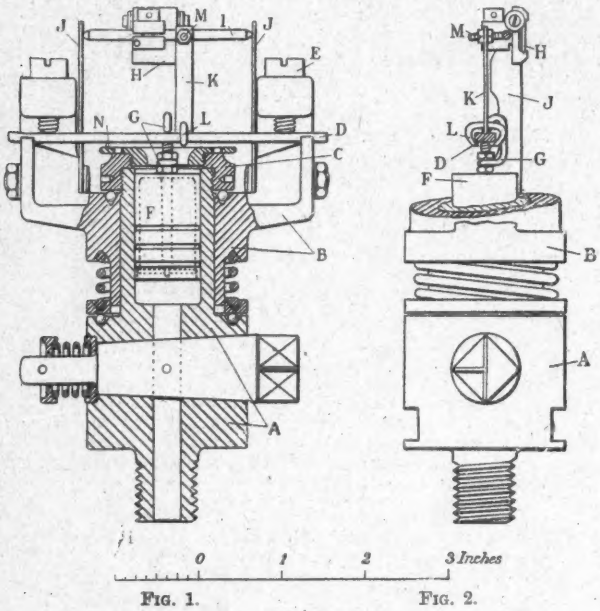


FIG. 1. FIG. 2.

of the frame B, and held by the screws E E. The spring is slightly bowed before insertion in the frame so that when the screws E E are screwed home, the spring is held straight with slight pressure on the four points of support.

The piston F slides in a bore in the block A. It is made hollow, but a plate closes its lower end. At the top it is provided with a hook G, the opening of which is slightly larger than the thickness of the spring. The piston is thus free to move laterally, and no binding action is possible between it and the sides of the bore such as would occur if the piston were rigidly attached to the spring.

The mirror H is clamped to a steel spindle I, the ends of which are pivoted in small holes in the vertical spring cheeks J J. The motion of the spring D is communicated to the spindle and mirror by means of the piece of vertical spring K. The lower end of this piece of spring is held firmly on the face of the main spring D by means of the jaws L; the upper end is firmly clamped to the arm M which projects at right angles from the mirror spindle. (See fig. 2, which is a section in a plane at right angles to fig. 1.)

The spring K, while sufficiently rigid to transmit the motion of the main spring to the end of the arm M without buckling, is flexible enough to allow for the angular motion of that arm. The mirror is thus turned about the axis of the spindle by an amount which is proportional to the displacement of the main spring D, and, therefore, to the pressure under the piston.

In order to give the other motion to the mirror the frame B is positively connected by linkage to a reciprocating part of the engine, and is thus caused to rock as a whole about the axis of the block A. The motion thus given to the frame B must be in phase

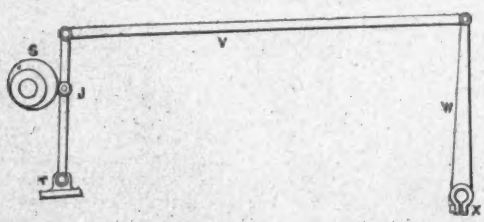


FIG. 3.—DIAGRAM OF LEVERS FOR OPERATING THE INDICATOR MIRROR.

with and proportional to the piston motion. In consequence of the smallness of the angular motion (about $\frac{1}{15}$ of a radian) of the frame B, it is easy to secure this result with simple gearing, the effect of the curvature of the paths of the joints in the linkage being negligible. A convenient arrangement is that shown diagrammatically in fig. 3, in which S is an eccentric fixed to the crank-shaft, and such that the diameter is to the throw as the crank-radius is to the length of the connecting-rod. The lever W is jointed at one end to the rod V, which takes its motion from one end of a lever pivoted at the other end T, and engaging with the eccentric by a roller J. At the other end W is fixed to a clamping ring X, which fits over the turned portion of the frame of the indicator, fig. 1.

The manner in which the diagrams are made visible is apparent from the diagram, fig. 4.

The source of light is a fine hole P illuminated by an ordinary 4-volt incandescent lamp. The rays from this, after reflection from the plane mirror of the indicator Q, fall upon the convex lens B_1, which is placed about 18 in. from the mirror and is 4 in. in diameter. The focal length of this lens is about equal to its distance from the mirror, and the beam of reflected light is therefore refracted to a direction about parallel with the axis of the lens. The beam comes to a focus in the plane B_2, and traces out in that plane the indicator diagram of the engine, the vertical displacements of the spot (corresponding to the tilting of the mirror about the spindle) being proportional to the pressure, and the horizontal displacements (corresponding to the rocking of the indicator frame) to the piston motion. With a sufficiently powerful source of light this diagram could be made visible by a ground-glass screen placed in the plane B_2, but in order to render it visible with a small lamp, a transparent screen is used and a second lens B_3 is interposed about 10 in. from B_2. This lens is of equal diameter with B_1, and refracts the beam of light (which before striking it is parallel to the axis) to its principal focus B_4 where the eye is placed. The beam is at the same time converted into a parallel beam, and the spot is seen sharply defined on the screen. The diagram traced by the spot is seen as a bright line of light. The screen is engraved with horizontal and vertical lines, on which the diagram is projected. The pressure at any point can thus be easily read off, or the diagram can be plotted down on squared paper.

Three pistons are used, the areas being in the ratio of 1, 2 and 4. There are two springs, which are ground so that the stiffnesses are in the ratio of 1 to 5. A wide range of sensibility is thus obtained. The smaller pistons fit inside liners which are inserted in the bore of the block A, fig. 1. The spring is very easily changed by slacking the screws E E and slipping the spring out together with the spindle and mirror, the spring cheeks J J being slightly separated

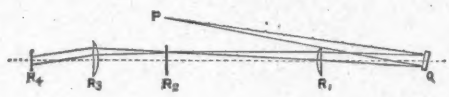


FIG. 4.

to allow of the spindle being taken out. When the spring has been removed the piston can also easily be taken out by removing the cap N, fig. 1, which serves also as a stop to prevent excessive bending of the spring.

The indicator is very easily calibrated by dead-weights. The calibration is found to remain constant within 1 or 2 per cent. when the spring is removed and replaced. Suction pressures are registered on the same scale as those above atmosphere, on account of the slight initial set in the spring.

Robertson's Fire Brigade.—At the ninth annual competition for the London Private Fire Brigades' Championship, the Robertson Electric Lamps Fire Brigade were again successful in carrying off the "Marshall" Championship Cup. There were 21 brigades in the competition, and this is the third time the Robertson Brigade have been successful in securing first place. Out of the events entered for they secured a first prize, three seconds and a fourth prize, and in addition to carrying off the Championship Cup, the Robertson Brigade also won the "Hitchcock" Shield, a new trophy for the brigade showing the best general improvement during the year. They also made a tie in the competition for the "Nestle" Cup, which carries with it the championship of the United Kingdom.

Electro-Deposition of Copper and Nickel to Form an Alloy.—Hille & Müller, of Porschdorf, near Schandau, in Saxony, have obtained a German patent for a process whereby they claim to be able to produce a deposit composed of a copper-nickel alloy upon any desired article. They remark that although a film of pure nickel is pleasant in colour, polishes well, and does not rust, the layer is so hard that it cannot be worked. If an alloy containing from 40 to 80 per cent. of copper could be deposited electrically, it would be very useful, inasmuch as such a layer would exhibit all the advantages of a film of pure nickel, and yet be tough, soft, and fit for mechanical treatment. Unfortunately an alloy of the kind in question cannot be deposited by the current in one operation. The inventors, therefore, propose to deposit by electrolysis first one metal and then the other, until the two films are of the proper thickness; and, finally, to heat the whole object to redness, when they unite to form an alloy. The coating is stated to be perfectly homogeneous, and to be particularly suitable for applying to projectile cases.

THE ELECTRIC INSTALLATION OF THE SS. "MAURETANIA."

The electrical installations on the *Mauretania* and her sister ship the *Lusitania* are of considerable importance, ranking as they do as the largest afloat, and equal to some of the equipments on land for supplying a city of 100,000 inhabitants. The generating plant consists of four sets of Parsons turbo-generators, each capable of supplying 4,000 amperes at 110 volts when run at a speed of 1,200 R.P.M.; and when compared with other large steamers of recent construction, such as the *Cedric*, which has four generating sets, each supplying 600 amperes at 100 volts, it will be seen how extensively electricity has been employed for lighting, heating, ventilation and auxiliary power on board these liners.

For the distribution throughout the ship there are nearly 100 tons of cables, having a length of some 250 miles. To meet the requirements of the Admiralty the cables had to be kept under the water line, necessitating a passage through the boiler space, and to withstand the heat specially prepared cables with an asbestos outer covering had to be used. These cables run along the ship's side on porcelain insulators, and are further protected by an iron channel.

The main switchboard is of massive construction in two sections, one in each engine room, and so arranged that should one compartment be flooded with water, the lighting could be supplied throughout the ship from the other side. The board contains a main circuit-breaker of 4,000 amperes capacity for each generating set, and 12 circuit-breakers of 1,000 amperes capacity each for the outgoing circuits. The breakers are fitted with time limit devices for each circuit, so that any sudden load, thrown on by the starting of the various motors, will not open the circuit-breakers unnecessarily. Each generator panel is also provided with an ammeter and voltmeter, and separate instruments are provided for taking the power of the various circuits and adjusting the voltage of the four generators.

There are some 6,000 lamps of 16 C.P. distributed throughout the ship, of which 720 are fitted in the engine room and stokehold. In the lighting of the public rooms the fittings are of a very handsome design specially prepared to harmonise with the character of the decorations. The general effect with all lights burning is like fairyland, everywhere being most brilliantly illuminated. In the staterooms, handsome ceiling lamps are fitted as well as portable reading lamps, radiators and connectors for curling tong heaters and electric fans.

The navigation lights are fitted with Martin's patent duplex indicator on the navigation bridge. This apparatus registers any failure in any of these lights, at the same time automatically switching in a spare filament in the lanterns and thus avoiding a total extinction.

Power.—In no other vessel has electricity been so extensively introduced for heating and ventilating, and driving auxiliary machinery. There are about 150 different motors varying from the 50 H.P. size for the forced draught fans to the ¼ H.P. motors for boot and knife cleaning machines, dish washers, potato peelers, &c. The most interesting of the above are the 16 motors of 50 H.P. for the forced draught fans. Four large motors operate the opening and closing of the main steam sluice valves, another four are for turning the main shafts, and six others are for lifting the covers of the turbines. Two motors operate bilge pumps, three are for driving the refrigerating machinery in the aft end of the vessel; and the passenger elevator and hoists for the mails, baggage and galley stores are all electrically driven. There are also four electric jib cranes for handling baggage, and four electric boat hoists.

For the ventilation and heating of the ship, there are no less than 90 motors, 28 of which supply air to the engine room and stokeholds, while 54 motors are connected to the thermotanks which supply hot or cold air to the passenger accommodation. In addition to the hot air supplied by the thermotanks, the deck staterooms are each provided with an electric radiator.

Telephones.—There are three separate systems for telephone communication fitted on board. Graham's loud-speaking telephones connect the navigation bridge to the crows' nest on the foremast, the forecastle head and the three engine rooms, also the steering gear and aft bridge. An intercommunication telephone system is fitted for the use of the officers and the engineers, and a telephone exchange for the first class passengers which can be connected to the shore immediately on the arrival of the vessel in port.

Fire Alarms.—A complete system of electric fire alarms is also fitted throughout the ship, a red lamp indicating their position, with indicators in the engine room and on the navigating bridge.

Clocks.—There are also about 50 clocks fitted throughout the ship, and these are all electrically controlled from the chart room.

An installation of this magnitude required a firm of large experience in the electrical equipment of ships, and Messrs. W. C. Martin & Co., of Glasgow, London and Newcastle, have carried out the work most successfully in every detail.

LEGAL QUERY COLUMN.

[*Questions addressed to the Editors for insertion in this column should be written on one side of the paper. Free use of fictitious names may be made. Answers are furnished by a barrister-at-law.*]

"Manager" writes:—"An electric supply company require to erect a 10-KW. transformer pillar with switchgear on a pathway. Their provisional order states that 'the undertakers may from time to time construct in any street such boxes as may be necessary for purposes in connection with the supply of energy. . . . Provided that no such box shall be placed above ground, except with the consent of the local authority.' Sec. 21, Board of Trade Regulations, states that '. . . sub-stations shall be placed above ground wherever possible.' Please state:—

"(*a*) Is the consent of local authority absolutely necessary?

"(*b*) Now that the advantages of overground boxes are realised, from what source is the power of erecting them derived?

"(*c*) The consent of local authority being obtained, and place for box marked out by their engineer, has the occupier of the neighbouring premises power to object to erection of box?"

*** As to (*a*) it is clear that the consent of the local authority is necessary. It is provided by Sec. 13 (1) of the Electric Lighting (Clauses) Act, 1899 (which applies in these cases), that where the local authority are not themselves the undertakers, no box or apparatus shall be placed above ground except with the consent of the authority, body or person by whom the street is repairable.

As to (*b*) power to erect an overground box appears to be derived from the clause quoted by "Manager," subject to veto by the local authority where it is proposed to put it above ground.

As to (*c*) it was decided some years ago in an English Court that where a supply company is entitled to place posts and pillars in a street for the purposes of supply, a frontager cannot object because a post happens to be placed in front of his door. It is apprehended that the same principle applies to the erection of a street box.

The Intensity of Daylight Illumination.—Some experiments have recently been carried out by Herr C. Paulus in order to measure the intensity of the illumination received on a horizontal surface at ground level from the direct rays of the sun, and also from the sky when the sun is hidden. The tests were made at the end of last August in the Municipal Electricity Supply Station of Munich. A Weber photometer was employed, the standard light being an Osmium lamp running at 4 volts. The day selected was perfectly free from cloud, but a slight mist prevailed in the early morning up to about 9 o'clock. Measurements were made every half-hour from 8 a.m. to 6.30 p.m., a final reading being obtained at 6 55 p.m. five minutes after the sun's rays were obscured by a neighbouring building. Four separate observations were made for each measurement, the average rising from 28,800 lux (2,380 candle-feet) at 8 a.m. to a maximum of 73,200 lux (6,220 candle-feet) at 12.30 p.m and falling to a minimum of 4,800 lux (408 candle-feet) at 6 30 p.m. The reading in the shade at 6.55 p.m. was 1,285 lux (109 candle-feet).

About the same date readings were made on three separate days at 11 a.m. of the diffused light received on a horizontal surface at a window having a north-east aspect, and, therefore, protected from the direct rays of the sun. On the first occasion the sky was covered with grey rain clouds in fairly rapid motion, and the light received on the observing surface was equal to 2,660 lux (226 candle-feet). On the second occasion the sky was quite free from cloud, and the air very clear; the diffused light falling on the surface was 3,400 lux (290 candle-feet). On the third occasion rain was falling heavily, and the illumination was equal to 1,410 lux (120 candle-feet).—*Zeitschrift für Beleuchtungswesen*, 1907, xiii., 188.

NEW PATENTS APPLIED FOR, 1907.

Compiled expressly for this journal by W. P. Thompson & Co., Electrical Patent Agents, 322, High Holborn, London, W.C., and at Liverpool, to whom all inquiries should be addressed.

19,378A/06. "Improvements in electrical signalling apparatus for use on and in connection with railway locomotive engines, and the like." A. C. Bounevialle. (Date applied for under Rule 5 of the Patents Rules, 1905, March 28th, 1907.) October 14th. (Complete.)

27,318A/05. "Apparatus for firing mines." K. Schaffler and D. Weiss. (Date applied for under Rule 5 of the Patents Rules, 1905, November 30th, 1906.) October 17th.

27,318B/06. "Apparatus for firing mines." K. Schaffler and D. Weiss. (Date applied for under Rule 5 of the Patents Rules, 1905, November 30th, 1906.) October 17th.

22,581. "Improvements in electric battery sub-stations fed from alternating-current systems." A. M. Taylor. October 14th.

22,605. "Improvements in systems of electric power transmission for driving ships' propellers and other apparatus." Siemens Bros. Dynamo Works, Ltd. (Siemens-Schuckertwerke G.m.b.H., Germany.) October 14th. (Complete.)

22,609. "Improvements in trolley mechanism." W. J. Craig. October 14th. (Complete.)

22,612. "Improvements in or relating to electric switches." O. Kjellberg. (Date applied for under Patents Act, 1901, November 1st, 1906, being date of application in Sweden.) October 14th. (Complete.)

22,619. "Improvements in the manufacture of electric conductors." S. O. Cowper-Coles. October 14th.

22,621. "Improvements in electro-galvanising." The Cowper-Coles Galvanising Syndicate, Ltd., and S. O. Cowper-Coles. October 14th.

22,624. "Improved reversing key or switch for electrical circuits." G. O. Harrison. October 14th.

22,634. "Improvements in and relating to ignition devices for internal combustion engines." A. Hommel. October 14th. (Complete.)

22,638. "Improvements in coils and telephones." W. E. Smith. October 14th. (Complete.)

22,648. "Apparatus for electrically firing mines." K. Schaffler and D. Weiss. October 14th.

22,676. "Improvements in or connected with boxes for electrical switches and the like." I. V. Zelander and T. Woods. October 15th.

22,700. "Multi-light fitting." H. Hirst and G. Maurice. October 15th.

22,719. "Improved method of and apparatus for controlling electrical circuits." A. J. Boult. (J. L. Woodbridge, United States.) October 15th. (Complete.)

22,722. "Improvements in ignition devices for reversible internal combustion engines." C. W. Askling. (Date applied for under Patents Act, 1901, October 22nd, 1906, being date of application in Sweden.) October 15th. (Complete.)

22,728. "Improvements in balancing the lines of electric circuits, particularly those employed in duplex systems of telegraphy." P. M. Justice. (The Rowland Telegraphic Co., United States.) October 15th. (Complete.)

22,729. "Improved construction of apparatus for applying electrical heat to the human body or places." A. B. Tubini. October 15th.

22,737. "Improvements in the transmission of electrical energy." W. F. Gradolph and W. C. Halme. October 15th. (Complete.)

22,745. "Improvements in telephone exchanges." Siemens Bros. & Co., Ltd. (Siemens & Halske Akt. Ges., Germany.) October 15th. (Complete.)

22,746. "Improved manufacture of incandescence filaments for electric incandescence lamps and apparatus therefor." Siemens & Halske Akt. Ges. (Date applied for under Patents Act, 1901, October 16th, 1906, being date of application in Germany.) October 15th. (Complete.)

22,747. "Improved manufacture of incandescence filaments for electric light from difficultly fusible metals." Siemens & Halske Akt. Ges. (Date applied for under Patents Act, 1901, October 26th, 1906, being date of application in Germany.) October 15th. (Complete.)

22,756. "Improvements in apparatus for the electric lighting of railway carriages." E. M. Preston and A. E. Kennard. October 15th.

22,761. "Improvements in electrical circuit closing devices." G. L. Anders and A. T. M. Thompson. October 15th. (Complete.)

22,806. "Improvements in or relating to electrical contact-breakers, particularly for use with internal combustion engines." P. A. Poppe. October 16th.

22,881. "Improvements in or relating to vapour electric apparatus." C. O. Bastian. October 16th.

22,882. "Improvements relating to armatures for dynamo-electric machines." B. G. Lamme. (Date applied for under Patents Act, 1901, November 3rd, 1906, being date of application in United States.) October 16th. (Complete.)

22,883. "Improvements relating to armature windings for dynamo-electric machines." F. Conrad. (Date applied for under Patents Act, 1901, November 3rd, 1906, being date of application in United States.) October 16th. (Complete.)

22,850. "Improvements in electrical indicating thermometers." Nalder Bros. & Thompson, Ltd., and F. H. Nalder. October 16th.

22,860. "Improvements in and relating to galvanic cells." M. Kalisz. October 16th.

22,868. "Improvements in electric motor control systems." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) October 16th.

22,869. "Improvements in electric resistance material." British Thomson-Houston Co., Ltd. (General Electric Co., U.S.) October 16th.

22,870. "Improvements in and relating to starting devices for electric motors." British Thomson-Houston Co., Ltd. (Allgemeine Elektricitäts-Ges., Germany.) October 16th.

22,904. "Improvements in magnetic rings, wristlets and anklets." E. Brown and J. Cameron. October 17th.

22,939. "Improvements in switch mechanism and safety devices for use in surface contact systems of electric traction." A. West. October 17th.

22,955. "Improvements in safety appliances for telpher lines, rope-ways and the like." J. W. White. October 17th.

23,004. "Improvements relating to generating and distributing electric current for lighting and other purposes." J. Jackson and T. Jackson. October 18th.

23,007. "Improvements relating to alternating electric current motors." F. Conrad. (Date applied for under Patents Act, 1901, November 3rd, 1906, being date of application in U.S.) October 18th. (Complete.)

23,043. "Improvements in and relating to arc lamps." D. Timar and K. von Dreger. October 18th. (Complete.)

23,054. "Improvements in devices for controlling the operation of electric switches." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) October 18th.

23,055. "Improvements in incandescent electric lamps." British Thomson-Houston Co., Ltd. (General Electric Co., United States.). October 18th.

23,056. "Electrically heated oven." E. Brown. October 19th.

23,058. "Improvements in the manufacture of electric incandescent lamps." Schott & Gen. (Date applied for under Patents Act, 1901, November 5th, 1906, being date of application in Germany.) October 19th. (Complete.)

23,116. "Improvements in metal-cored flame carbons for electric arc lamps." M. Hamang. October 19th.

23,126. "Improvements in or relating to fuse-controlled electrical apparatus." A. F. Berry. October 19th. (Complete.)

23,142. "Improvements in and relating to dynamo-electric machines." British Thomson-Houston Co., Ltd. (Allgemeine Elektricitäts, Germany.) October 19th.

23,143. "Improvements in single-phase dynamo-electric machines." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) October 19th.

23,144. "Method for transforming electric energy of any desired kind into direct currents of any desired tension." A. Lotz. (Date applied for under Patents Act, 1901, October 20th, 1906, being date of application in Germany.) October 19th. (Complete.)

23,145. "Improvements in apparatus for purifying electrolytes." S. O. Cowper-Coles. October 19th. (Complete.)

23,148. "Improvements in electric arc lamps." Johnson & Phillips, Ltd., and C. F. Tubbs. October 19th. (Complete).

23,150. "An improved bracket for holding the non-conducting buttons used for laying electric conduits." J. Konig. October 19th. (Complete.)

PUBLISHED SPECIFICATIONS.

Copies of any of these Specifications may be obtained of Messrs. W. P. Thompson & Co., 322, High Holborn, W.C., and at Liverpool price, post free, 9d. (in stamps).

1906.

Apparatus for Use in Electric Telegraph Systems. A. T. M. Johnson and Johnson Secret Wireless Telegraph and Telephone Testing Syndicate. 16,746. July 24th.

Splicing Ear for Electric Trolley Wires and the like. B. Croft. 18,687. August 21st.

Telephonic Apparatus. E. A. Graham. 18,965. August 24th.

Compensated Dynamo-Electric Machines having Commutating Poles. Allgemeine Electricitäts Ges. 20,808. September 19th. (Date applied for under International Convention, September 20th, 1905.)

Process and Apparatus for the Treatment of Metallic Tungsten, and for the Manufacture of Electric Lamp Filaments Therefrom. British Thomson-Houston Co. (General Electric Co., United States.) 21,513. September 28th.

Manufacture of Electric Incandescent Lamps having Metal Filaments. British Thomson-Houston Co. (General Electric Co., United States.) 21,669. October 1st.

Arc Lamps. H. E. Angold and the Maxim Electrical Co. 23,012. October 17th.

Inductor Electric Generator. P. Rabbidge. 24,669. November 3rd.

Dynamo-Electric Generators. H. Leitner. 27,210. November 29th.

Lightning Arresters and like Protective Devices for Electrical Installations. Allgemeine Elektricitäts Ges. 28,509. December 18th. (Date applied for under International Convention, January 2nd, 1906.)

1907.

Alternating-Current Commutating Electric Machines. Allgemeine Elektricitäts Ges. 12,090. May 24th. (Date applied for under International Convention, May 25th, 1906.)

Electrodes for Searchlights. Geb. Siemens & Co. 15,388. July 3rd. (Date applied for under International Convention, December 17th, 1906.)

Supports for the Filaments of Incandescent Electric Lamps. British Thomson-Houston Co. (Allgemeine Elektricitäts Ges.) 1,196. January 16th.

Machines for Use in the Manufacture of Incandescent Electric Lamps. British Thomson-Houston Co. (General Electric Co., United States.) 1,585. January 6th.

Electrical Apparatus for Automatically Indicating the Positions of Trains on Railways. B. Trautmann née Sprie. 2,053. January 26th.

Brushes for Use in Dynamo-Electric Machines. Akt.-Ges. Brown, Boveri and Cie. 2,202. January 29th. (Date applied for under International Convention, February 2nd, 1906.)

Manufacture of Compositions of Matters of a Refractory Character and Adapted for Electrical Insulation and other Uses. A. G. Brooks. (Asbestos Wood Co.) 2,460. January 31st.

Electric Time Switches. J. Cauderay. 2,604. February 1st. (Date applied for under International Convention, February 6th, 1906.)

Electrical Transmission of Power. Siemens Bros. Dynamo Works, Ltd. (Siemens Schuckertwerke Ges.) 2,687. February 2nd.

Iron Electrodes for Accumulators with Alkaline Electrolyte, and Method for Manufacturing Same. E. W. Jungner. 3,631. February 13th. (Date applied for under International Convention, February 14th, 1906.)

Method of Producing Electro-Active Cement-Like Substances of Iron and Nickel Hydrates for Forming Electrodes, and Accumulators Constructed with such Electrodes. E. W. Jungner. 3,711. February 14th. (Date applied for under International Convention, February 15th, 1906.)

Method for the Production of Electrodes of Magnetic Metals by means of Electrolytic Oxidation, Electrodes Produced in this Matter and Accumulators Provided with such Electrodes. E. W. Jungner. 3,834. February 15th. (Date applied for under International Convention, February 16th, 1906.)

Signalling by Electro-Magnetic Waves. R. A. Fessenden. 4,714. February 26th.

System of Push Button Apparatus for Operating or Controlling Electric Lifts. J. Mair. 5,958. March 15th.

Apparatus for Controlling Electric Currents. E. de Bremaecker. 6,341. March 15th.

Electric Brakes for Electro-Motors. M. Kallmann. 6,973. March 22nd.

Thermo-Mercurial Electric Contact Makers. N. M. Ogle. 7,529. March 28th.

Electro-Magnetic Devices for the Obtaining of a Sequence of Effect as Applied to Automatic Controlling Devices and the like. R. A. Smith and H. Linzell. 7,964. April 5th.

Dynamo-Electric Machines Provided with Commutating Poles. C. A. Mudge. 9,554. April 24th. (Date applied for under International Convention, August 24th, 1906.)

Means for Locking Electric Switch Boxes. C. A. Day. (Meyer Akt.-Ges.) 9,743. April 26th.

Operating Devices for Electrical Switches for Use in Connection with Train Controlling Systems. Siemens Schuckertwerke Ges. 11,475. May 16th. (Date applied for under International Convention, June 16th, 1906.)

System of Operating Electric Vehicular Traffic. H. Tudor. 11,501. May 16th.

Electrodes for Resistance Furnaces. R. Rochling, J. Schoenawa and W. Rodenhauser. 11,917. May 22nd.

Electric Arc Lamps. J. O. Girdlestone and C. P. G. Thorkelin. 12,221. May 27th.